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# FINAL
# ENVIRONMENTAL IMPACT STATEMENT

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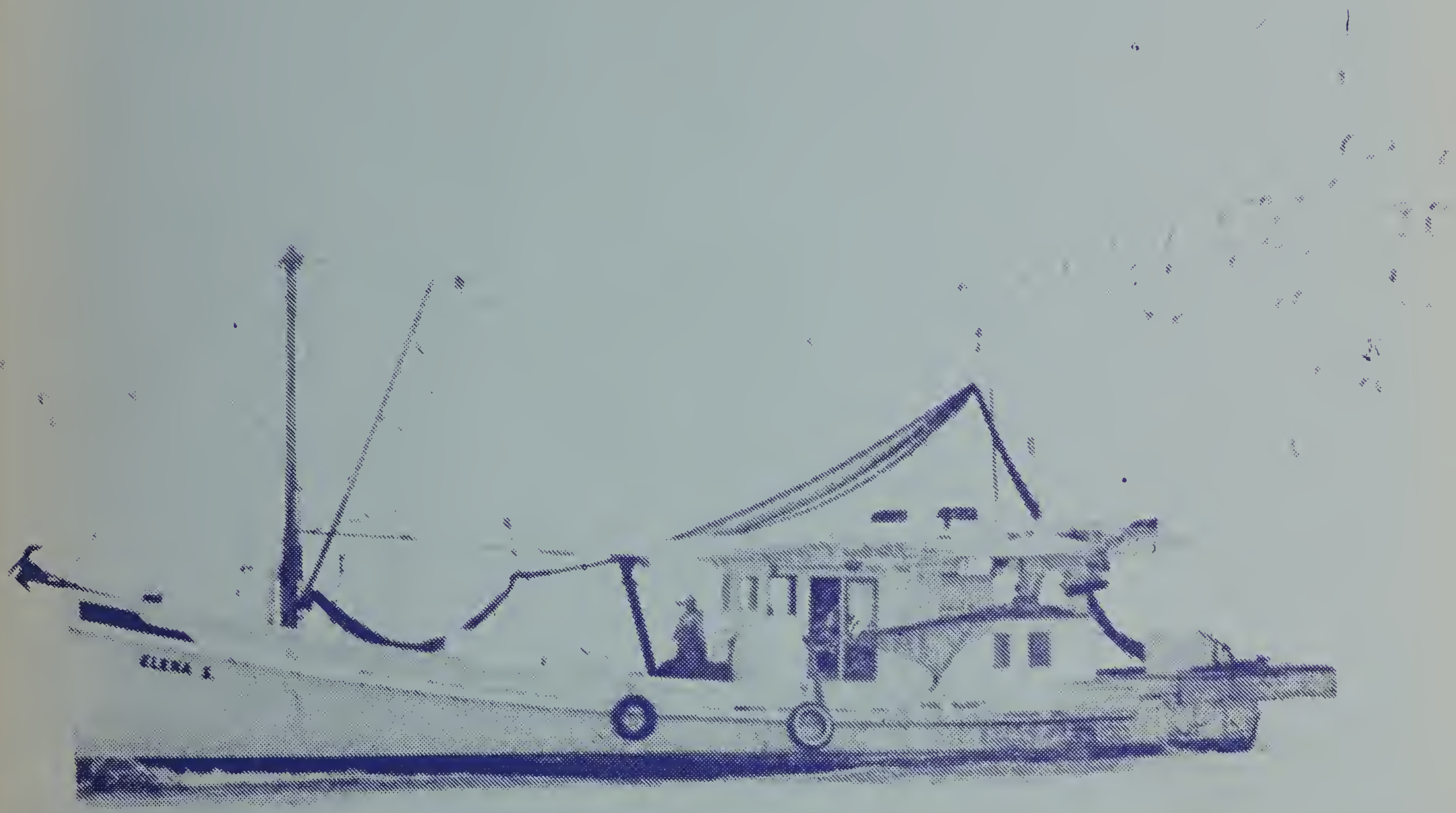
VOLUME 1 OF 2



## PROPOSED
## 1976 OUTER CONTINENTAL SHELF
## OIL AND GAS LEASE SALE
## GULF OF MEXICO

## OCS SALE 44

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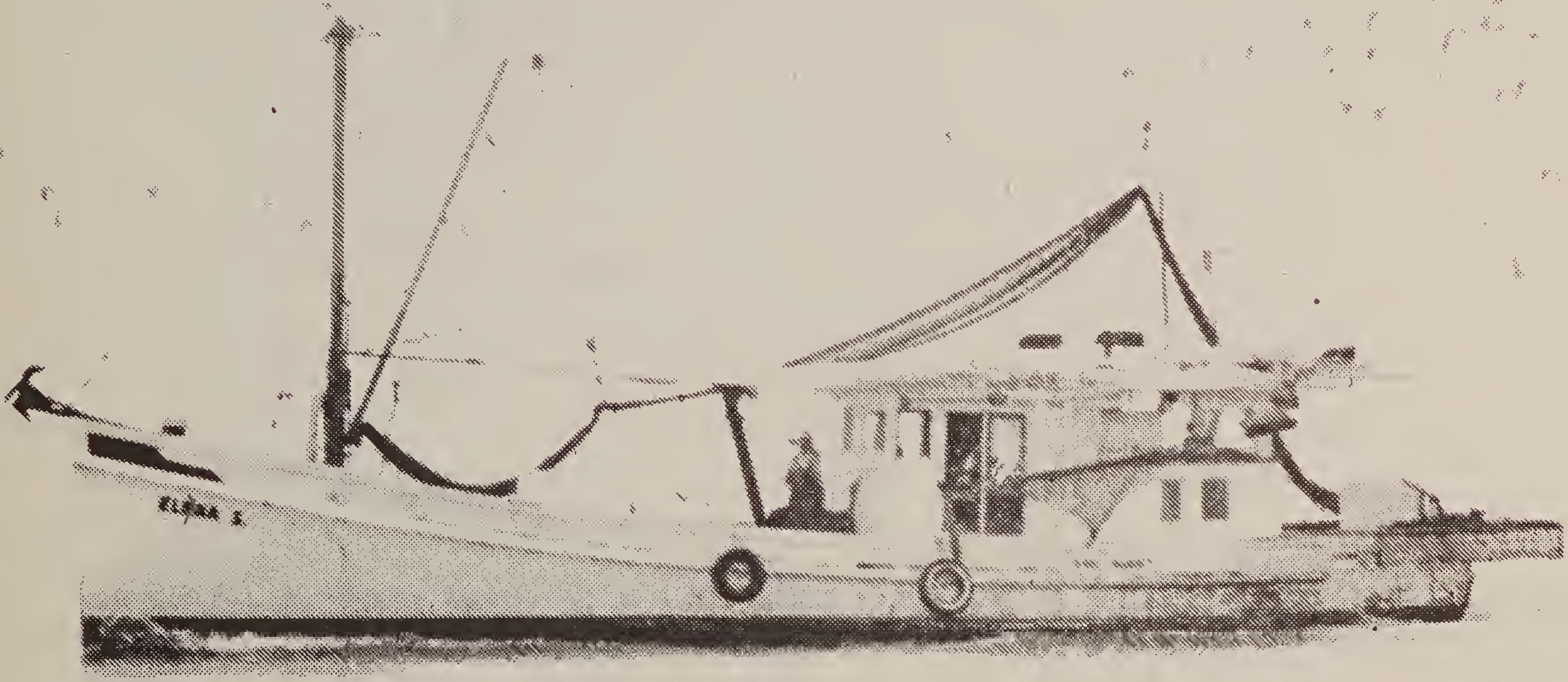
VOLUME 1 OF 2



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PROPOSED
1976 OUTER CONTINENTAL SHELF
OIL AND GAS LEASE SALE
GULF OF MEXICO

OCS SALE 44

Curt Berklund
DIRECTOR

# Summary: Proposed OCS Lease Sale No. 44

( ) Draft (X) Final Environmental Statement

**Department of the Interior, Bureau of Land Management, New Orleans OCS Office**

1. Proposed Oil and Gas Lease Sale, Outer Continental Shelf Gulf of Mexico

(X) Administrative ( ) Legislative Action

2. Sixty-one tracts 254,488 acres (102,991 ha) of OCS land are proposed for leasing action. The tracts are located offshore Texas and Louisiana. If implemented, this sale is tentatively scheduled to be held in November 1976.

3. All tracts offered pose some degree of pollution risk to the environment. The risk potential is related to adverse effects on the envionment and other resource uses which may result principally from accidential or chronic oil spillage. Each tract offered is subjected to a matrix analyses technique in order to evaluate significant environmental impacts should leasing and subsequent oil and gas exploration and production ensue.

4. Alternatives to the proposed action:

**A. Hold the Sale in Modified Form**
  1. Sale Modification Alternatives
    a. Delete tracts
    b. Substitute tracts
**B. Withdraw the Sale**
  1. Energy Conservation
  2. Conventional Oil and Gas Supplies
  3. Coal
  4. Nuclear Power
  5. Oil Shale
  6. Hydroelectric Power
  7. Solar Energy
  8. Energy Imports
  9. Geothermal Energy
  10. Other Energy Sources
  11. Combination of Alternatives
**C. Delay the Sale**
**D. Alternative With the Proposed Action; Government Exploratory Drilling Before Leasing**

5. Comments have been requested from the following:

*Department of Commerce
  National Oceanic and Atmospheric Administration
*Department of the Army, Corps of Engineers
Department of the Interior
  *Bureau of Mines
  *Bureau of Outdoor Recreation
  *Fish and Wildlife Service
  *Geological Survey
  National Park Service
  *Office of the Solicitor
Department of Transportation
  *Materials Transportation Bureau
  *U.S. Coast Guard
*Energy Research and Development Administration
*Environmental Protection Agency
*Federal Energy Administration
*Federal Power Commission
*Nuclear Regulatory Commission
*State of Louisiana, Office of State Planning
*State of Texas, Division of Planning Coordination
*Advisory Council on Historic Preservation

6. Draft Statement made available to Council on Environmental Quality and the public on June 2, 1976.

7. Final statement made available to Council on Environmental Quality and the public on SEP 3 1976

*Comments received.

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6. Transportation and Coastal Refining Centers.

Note:

The regulations to which reference is made throughout this environmental statement are 30 CFR 250 and 43 CFR 3300 and Geological Survey OCS Orders Nos. 1 through 14 - Gulf of Mexico. These OCS Orders for the Gulf of Mexico may be obtained from the New Orleans OCS office. The CFR's cited may be obtained from the United States Department of the Interior, Washington, D. C.

# DESCRIPTION OF PROPOSAL

## Location and Reserves

The proposed sale under consideration includes 61 tracts offshore Texas and Louisiana. Tracts are summarized by location, expected type of production, acreage, distance from shore and water depth in Appendix A. These tracts, if leased, would add approximately 102,991 hectares, an increase of about 3%, to the current total of 3.1 million hectares (as of March 5, 1976) under federal lease in the Gulf of Mexico. Thirty-four of the tracts (approximately 49,158 hectares) are drainage tracts, 27 tracts (approximately 53,833 hectares) are development tracts and none are wildcat tracts. The tracts in this proposed sale range from three meters to 200 meters in water depth and from 4.8 to 175 kilometers from shore (Visual No. 1). One tract is located in water depth of 200 meters or more. Eighty-two percent of the tracts offered are gas prone, three percent are oil prone, and fifteen percent are oil and gas prone. The proposed lease sale would be made under Section 8 of the Outer Continental Shelf Lands Act (76 Stat. 462; U.S.C. Sec. 1337) and regulations issued under that statute.

The estimated undiscovered recoverable reserves which could be developed as a result of this sale amount to 100 to 200 million barrels of oil and one to three trillion cubic feet of gas. This would require an estimated 100 to 300 wells from 20 to 40 platforms and require approximately 161 kilometers of pipelines. It is estimated that the proposed leases may produce 7,500 to 30,000 barrels of oil per day and 90 to 360 million cubic feet of gas per day after development and production stabilizes. After consultations with industry representatives and the U.S. Geological Survey, it is not anticipated that any barging of production from offshore sites to onshore receiving facilities will occur as a result of this proposed sale.

## Legal and Administrative Background

In 1953, the Outer Continental Shelf (OCS) Lands Act (67 Stat. 462) established Federal jurisdiction over the submerged lands of the continental shelf seaward of the state boundaries. The Act charged the Secretary of the Interior with the responsibility for the administration of the mineral exploration and development on the OCS. It also empowered the Secretary to formulate regulations so that the provisions of the Act might be met.

Subsequent to the passage of the OCS Lands Act of 1953, the Secretary of the Interior designated the Bureau of Land Management (BLM) as the administrative agency for leasing of submerged federal lands, and the U.S. Geological Survey (USGS) for supervising operations on the OCS. The Department formulated three major goals for the comprehensive management program for marine minerals. These are (1) The orderly development of the marine mineral resources to meet the energy demands of the nation. (2) The protection of the marine and coastal environment. (3) The receipt of a fair return for the leased minerals resources. These leasing objectives are based on legislative mandates as explained below.

(1) Orderly resource development is based on the OCS Lands Act which gives the Secretary the authority, in order to meet the urgent demand for oil and gas, to grant leases to the highest qualified bidder(s) on the basis of sealed competitive bids. (2) Protection of the marine and coastal environment is a direct outgrowth of the National Environmental Policy Act of 1969. This act requires that all federal agencies shall utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences in any planning and decision-making which may have an impact on man's environment. The products of BLM efforts in this direction are Environmental Impact Statements (EIS), Environmental Assessment Teams and contract studies designed to identify and characterize different types of environments and the problems that they face. (3) Receipt of fair market value has its base in two separate mandates. United States Code 31, Sec. 483 (a) obligates the Federal Government to obtain a fair return for public lands that are sold or leased. This is further implemented within the Executive Branch by the Bureau of Budget Circular A-25.

## Tract Selection Process

Ordinarily, the proposed lease sale process begins with the Interior's Call for Nominations and Comments, an invitation to industry to designate specific tracts it is interested in bidding on if a sale is held, and to government agencies, private organizations and individuals to pinpoint for various reasons areas they believe should not be leased.

In the case of this proposed sale, the process begins with the tract selection announcement. The changed procedure is authorized under Interior regulations which allow the Director of BLM, with the recommendation of the Director of the U.S. Geological Survey, to select drainage and development tracts without first calling for nominations and comments. Areas designated for the proposed lease sale include both "drainage" tracts—those which may share a producing oil and/or gas reservoir with adjacent tracts—and "development" tracts—those located on geological structures that have been known to contain oil and/or gas.

This type of sale is sometimes considered necessary for timely, orderly development in well-established, highly developed OCS leasing areas of the Gulf of Mexico. There have been 11 such selections and sales over the years in the Gulf of Mexico.

### Leasing History

A total of 61 tracts containing approximately 254,488 acres (102,991 hectares) have been identified for potential leasing under this tract selection process. Ten of these tracts, containing 28,196 acres (11,411 hectares) have been leased previously. Seventeen of the tracts, containing 71,335 acres (28,869 hectares) that had been offered previously, received bids, but were ultimately rejected.

### Geological Considerations

In February 1976, the Bureau of Land Management in New Orleans requested preliminary geological and geophysical data from USGS for the area included within the proposed sale. This evaluation was completed and the review by USGS covered the following: Resource estimates; geological information; geophysical data; actions planned to meet data needs; problems associated with exploration and development; and drainage of adjacent state lands. In the great majority of cases, the USGS data confirmed the recommendations as determined by the initial analysis of nominations.

### Environmental Considerations

Responsibility for the initial tract selection lies with the New Orleans OCS office of the Bureau of Land Management and the U.S. Geological Survey under guidance furnished by the respective Washington offices as to Departmental policy and objectives. BLM and USGS also consider recommendations by the U.S. Fish and Wildlife Service regarding permits for exploration and minerals development.

Specifically, the tract selection process included a detailed analysis of all areas in which possible environmental degradation might occur as a result of oil exploration and development. The environmental resource categories receiving evaluation included:

Geology (bottom sediments and paleontology)
General climatology and seasonal weather patterns (visibility, winds, temperature, inversions, storms and precipitation)
Physical oceanography (sea temperatures, salinity, surface circulation including currents, waves, swells, and tides)
On and offshore outdoor recreation
Archaeological and historical sites Land Use
Socio-economics (population, employment, income, economic characteristics, agriculture, refining and processing facilities
Transportation networks
Air and water quality
Physical hazards (ocean dumping areas, military activities, existing pollution factors, undersea cables, ship transit lanes, shipwrecks and harbor areas)
Terrestrial soils and vegetation
Plankton, benthos, nekton and biological sensitive areas
Intertidal and reef communities
Endangered species
Areas of unique biological significance and marine life preserves
Terrestrial birds and wildlife
Marine birds and mammals
Commercial and sport finfish and shellfish
Beach and shoreline areas
Aesthetic and scenic values

The above basic information was then interpreted (using both written documentation and map overlays) in regard to the potential impacts or hazards which might affect individual resources as a result of offshore drilling and development, pipeline construction and oil spillage. From these interpretations "potential environmental hazard zones" were developed for use in the tract selection process. This type of procedure was also used in evaluating other considerations as well.

### Other Considerations

Other areas which were reached and evaluated as part of the tract selection process were: use conflicts (defense warning zones, etc.), policy guidelines and possible drainage of reserves from state lands.

## Activity Resulting from this Proposal in the Gulf of Mexico

The amount of commercial activity that may be generated in the Gulf of Mexico region as a result of this proposal is dependent on many variables. Chief among these variables would be the availability of capital, manpower, equipment and the amount of proven recoverable resource. Table D-1 summarizes the range of activities required to develop the estimated reserves within the proposed lease sale tracts.

TABLE D-1.—*Summary of the range of activities required to develop the estimated reserves within the proposed lease sale tracts*

| | This proposed sale |
|---|---|
| 1. *Estimated acreage, construction activity and reserves:* | |
| a. Acres (millions) | [1] 0.140 |
| b. Production wells | 100–300 |
| c. Platforms | 20–40 |
| d. Miles of pipelines | 100–200 |
| e. Terminal storage facilities | 0–2 |
| f. Reserves: | |
| Oil (million bbl.) | 100–200 |
| Gas (trillion cu. ft.) | 2–3 |
| 2. *Estimated annual crude oil transportation:* | |
| Transported by tankers (bbls./yr.) | 0 |
| Transported by pipeline: | |
| Minimum estimate (million bbls./yr.) | 2.7 |
| Maximum estimate (million bbls./yr.) | 10.9 |
| 3. *Estimated volume of commercial mud and drill cuttings:* | |
| Assume 200 wells with average depth of 10,000 feet. | |
| Cuttings: 682 tons per well; Mud components: 230 tons per well, assume 10% consumed during drilling, balance reused in other wells. | |
| Drill cuttings (tons) | 1,364,000 |
| Mud components (tons) | 506,000 |
| 4. *Estimated volume of produced formation water proposed lease sale area:* | |
| Assume 0.6 barrels formation water produced for each barrel of oil and condensate: | |
| Annual production (million bbls./yr.) | 1.6–6.5 |
| Total production (20 yrs) (million bbls.) | 32–130 |
| 5. *Estimated total land use requirements for onshore facilities:* | |
| 0–32 hectares. | |
| 6. *Estimated pipeline burial disturbance:* | |
| Offshore equals (where burial required) 4,921–9,841 cubic meters/kilometers. | |
| Onshore equals A zone 9–12 meters wide along pipeline right-of-way. | |

[1] Estimated that 55% of the acreage proposed for offering in this proposed sale will lease.

## Relationship of the Proposed Action to Existing and Prospective Offshore Oil and Gas Development in the Gulf of Mexico

This proposed action must be viewed as one part of a continuing activity that has been underway in the Gulf of Mexico since the 1940's. Although primary emphasis concerning the description of the proposal and its potential environmental effects has been placed on this particular proposed sale in isolation from all previous activities of the same nature, it should also be put into the perspective of an on-going offshore oil and gas development process. As of February 18, 1976, there have been 32 OCS oil and gas (and five OCS sulfur and salt) lease sales on submerged lands in federal OCS areas of the Gulf of Mexico (Table E-1).

TABLE E-1.—*Total acreage leased in Gulf of Mexico from the inception of OCS leasing activities through March 5, 1976*

| Area | Acreage |
|---|---|
| Louisiana | 8,361,383 |
| Texas | 3,169,572 |
| Mississippi, Alabama and Florida | 508,437 |
| Total | 12,039,392 |

*Acreage currently under lease in Gulf of Mexico as of March 5, 1976*

| Area | Acreage |
|---|---|
| Louisiana | 5,540,297 |
| Texas | 2,116,799 |
| Mississippi, Alabama and Florida | 404,757 |
| Total | 8,061,853 |

The Geological Survey has issued an approximate total of 1,222 pipeline permits on the OCS resulting in 3,758 kilometers of offshore pipelines.

As production declines in existing areas (during the next 5-10 years), some of the equipment, transportation facilities, pipelines, platforms and personnel can be utilized in new areas of activity. As existing areas of production decline, the pipelines in place for that system can be used for new production areas, adjacent or further from shore, thereby reducing the quantity of pipelines necessary to transport production from new areas to shore. The utilization of existing facilities and equipment could also result in a reduction in the quantity of onshore facilities estimated to be required for the transportation and processing of hydrocarbons that may be produced as a result of this proposed sale.

## Development of Proposed OCS Planning Schedules for Potential OCS Oil and Gas Leasing and the Department's Program to Accelerate OCS Oil and Gas Leasing Nationwide

Proposed OCS planning schedules are developed in order to project the timing, size and location of specific lease sales for an OCS leasing program. General sale areas are identified and, at a later date, tentative acreage figures are set through the tract selection process for each proposed sale on the basis of broad resource knowledge and environmental evaluation. The goal of the proposed schedule is to provide for orderly development of OCS oil and gas resources and to maintain an adequate contribution of OCS production to the national supply.

In developing a proposed OCS planning schedule, the Department considers the three leasing objectives that have been set for a Departmental OCS program. These objectives are: orderly and timely resource development, protection of the environment and receipt of fair market value. The overriding factor in planning for OCS leasing is to strive for a supply of oil and natural gas adequate to meet the demand for these resources, consistent with the protection of environmental values. This is the foundation of and justification for the existence of the OCS leasing program. The tentative acreage selection process that follows must consider the need to balance supply with demand. Acreage is tentatively selected in sufficient amount to engender industry interest and promote a fair market return.

The proposed OCS planning schedule is essential as a program planning document to enable the Department to proceed in an orderly and timely fashion with its process of considering the several proposed and possible lease sales identified in that document. The proposed OCS planning schedule aids the Department of the Interior in establishing the order in which areas will be examined and in planning the work assignments of personnel and the allocation of resources for the environmental and other studies enumerated. The proposed OCS planning schedule also serves to apprise federal, state, and local agencies, industry, and interested members of the public of the time frame for consideration of potential leasing in the identified areas of the OCS. The proposed OCS planning schedule is a flexible document that is subject to revision at any time. More particularly, the consideration of any proposed or possible sale is subject to being terminated, modified, deferred, or advanced.

In May 1974, the Department announced that it would prepare a draft environmental impact statement on the proposed program to accelerate OCS oil and gas leasing from three to ten million acres (1.2 to 4 million hectares) in 1975. This proposal considers the entire United States' Outer Continental Shelf. A draft environmental impact statement on this proposed program was published in October, 1974, submitted to CEQ and made available to the public for review and comment. Public hearings were held in February, 1975, on the draft statement in Anchorage, Alaska; Beverly Hills, California; and Trenton, New Jersey.

In November, 1974, the Department modified the goal of its proposed accelerated OCS oil and gas leasing program nationwide from leasing 10 million acres (four million hectares) in 1975 to holding six proposed lease sales (a proposed sale, as used herein, refers to a tentative sale as to which tract selections have been made for the purpose of preparing a site-specific environmental impact statement) in 1975 and six possible lease sales (a possible sale, as used herein, refers to a tentative sale which has been listed on a proposed planning schedule, but has not reached the tract selection stage of the consideration process) per year for the period 1976 through 1978, offering prospects in each frontier area (frontier area refers to any of the 17 recognized OCS areas in which there has been no prior Federal oil and gas leasing) by the end of 1978. Accelerated leasing remains an integral part of the proposal, but the specific acreage figure has been eliminated.

On November 14, 1974, a new proposed OCS planning schedule was announced by the Department of the Interior at a conference with the coastal States' Governors. The proposed OCS planning schedule, issued in November, 1974, was revised in June, 1975 (Figure F-1) to reflect changes in the timetables for considering certain possible sales listed on that schedule.

Some of the major resource, environmental and technological factors weighed in developing the proposed OCS planning schedule issued in November 1974 were as follows:

1. Review of the Council on Environmental Quality's environmental reports concerning the Gulf of Alaska and Atlantic OCS, and consideration of their ranking of areas by environmental risk and their concern for adequate regulation and utilization of technology. The Department has recently responded to this report, outlining the steps being taken on the basis of CEQ's recommendations.

2. Review of the results of Interior's survey of industry, state, and local governments, and interested members of the public concerning resource potential, leasing preferences, and matters of environmental concern. These results were published in June, 1974.

Figure F-1

## PROPOSED OCS PLANNING SCHEDULE

JUNE 1975
(REVISES NOVEMBER 1974 SCHEDULE)

| SALE AREA | 1974 | | | | | | 1975 | | | | | | | | | | | | 1976 | | | | | | | | | | | | 1977 | | | | | | | | | | | | 1978 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | A | S | O | N | O | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | O | J | F | M | A | M | J | J | A | S | O | N | D |
| SOUTH TEXAS 37 | | DES | PH | | BSI FES | | N | Sale | | | | | S | A | L | E | | H | E | L | D | | I | N | | F | E | B | R | U | A | R | Y | | 1 | 9 | 7 | 5 | | | | | | | | | | | | | | | | |
| CENTRAL GULF 38 | ND | | | T | | DES DES | PH | | FES | N | Sale | | | | | | | S | A | L | E | | H | E | L | D | | I | N | | M | A | Y | | 1 | 9 | 7 | 5 | | | | | | | | | | | | | | | | |
| CENTRAL GULF 38A | ND | | | T | | DES | PH | | FES | N | | | Sale | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SOUTHERN CALIF. 35 | | T | | | | | | DES | | | PH | BSI | | FES | N | Sale | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| COOK INLET 1/ | F | E | D | E | R | A | L | | - | | S | T | A | T | E | | S | A | L | E | | - | | D | A | T | E | | U | N | C | E | R | T | A | I | N | | | | | | | | | | | | | | | | | |
| GULF OF ALASKA 39 | BSI | | | | C | ND | | | T | | | DES | | PH | | FES | N | Sale | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GULF OF MEXICO (GENERAL) 41 | | | | | | C | ND | | T | | | | DES | | PH | | | FES | N | Sale | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MID-ATLANTIC 40 | | | | | | | | | C | | | BSI ND | | T | | DES | | PH | | | FES | N | Sale | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NORTH ATLANTIC 42 | | | | | | | | | | | | C | | ND | BSI | T | | | DES | | PH | | | FES | N | Sale | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GULF OF MEXICO (DRAINAGE) 44 | | | | | | | | | | | | | | | | | | T | | | DES | | PH | | | FES | N | Sale | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SOUTH ATLANTIC 43 | | | | | | | | | | | | | C | | | BSI ND | | | T | | | DES | | PH | | | FES | N | Sale | | | | | | | | | | | | | | | | | | | | | | | | | |
| GULF OF ALASKA (INCLUDING KODIAK) 46 | | | | | | | | | | | | | BSI | | | C | | ND | | T | | | DES | | PH | | | FES | N | Sale | | | | | | | | | | | | | | | | | | | | | | | | |
| BERING SEA (ST. GEORGE) 45 | | | | | | C | ND | | | | BSI | | T | | | | | | | | | | | | | DES | | PH | | | FES | N | Sale | | | | | | | | | | | | | | | | | | | | | |
| GULF OF MEXICO (DEEP) 47 | | | | | | | | | | | | | | | | | | | C | | ND | | | T | | | DES | | PH | | | FES | N | Sale | | | | | | | | | | | | | | | | | | | | |
| SO. CALIFORNIA 48 | | | | | | | | | | | | | | | | | | | | | C | | ND | | | T | | | DES | | PH | | | FES | N | Sale | | | | | | | | | | | | | | | | | | |
| MID-ATLANTIC 49 | | | | | | | | | | | | | | | | | BSI | | | | | | C | | ND | | | T | | | DES | | PH | | | FES | N | Sale | | | | | | | | | | | | | | | | |
| BEAUFORT SEA 50 | | | | | | | | | | | BSI | | | | | | | | | | | | | | C | | ND | | | T | | | DES | | PH | | | FES | N | Sale | | | | | | | | | | | | | | |
| OUTER BRISTOL BASIN 51 | | | | | | | | | | | BSI | | | | | | | | | | | | | | | | C | | ND | | | T | | | DES | | PH | | | FES | N | Sale | | | | | | | | | | | | |
| NORTH ATLANTIC 52 | | | | | | | | | | | | | | | BSI | | | | | | | | | | | | | | C | | ND | | | T | | | DES | | PH | | | FES | N | Sale | | | | | | | | | | |
| CALIFORNIA GENERAL INCL. WASH. & OREGON 53 | | | | | | | | | | | | | | | | | | | | | | | | | | BSI | | | | | C | | ND | | | T | | | DES | | PH | | | FES | N | Sale | | | | | | | | |
| SOUTH ATLANTIC (BLAKE PLATEAU) 54 | | | | | | | | | | | | | | | | | | | BSI | | | | | | | | | | | | | | C | | ND | | | T | | | DES | | PH | | | FES | N | Sale | | | | | | |
| BERING SEA (NORTON BASIN) 55 | | | | | | | | | | | | | | | | | | | | | BSI | | | | | | | | | | | | | | C | | ND | | | T | | | DES | | PH | | | FES | N | Sale | | | | |
| GULF OF ALASKA – ALEUTIAN SHELF 56 | | | | | | | | | | | | | BSI | | | | | | | | | | | | | | | | | | | | | | | | C | | ND | | | T | | | DES | | PH | | | FES | N | Sale | | |
| CHUKCHI SEA HOPE BASIN 57 | | | | | | | | | | | | | | | | | | | | | | | | | BSI | | | | | | | | | | | | | | C | | ND | | | T | | | DES | | PH | | | FES | N | Sale |

BSI Baseline Studies Initiated
C Call for Nominations
ND Nominations Due
T Announcement of Tracts
DES Draft Environmental Statement
PH Public Hearing
FES Final Environmental Statement
N Notice of Sale
1/ State May Conduct Sale

Baseline studies scheduled are contingent upon scientific personnel and equipment being available to perform the studies.

Sales are contigent upon technology being available for exploration and development. A decision whether to hold any of the lease sales listed will not be made until completion of all necessary studies of the environmental impact and the holding of public hearings; as a result of the environmental, technical, and economic studies employed in the decision – making process, a decision, may, in fact, be made not to hold any sale on this schedule.

March 3, 1849

Curt Berklund

Director,
Bureau of Land Management

3. Collection and examination of considerable amount of resource data gathered in seismic surveys of these areas.

This proposed OCS planning schedule does not represent a decision to lease in any of these particular areas. It represents only the Department's intent to consider leasing in such areas and to proceed with the leasing development of such areas if it should be determined that leasing and development in such areas would be environmentally, technically and economically acceptable. Thus, the modified program proposal to accelerate OCS oil and gas leasing entails leasing of some tracts in all of the frontier areas by the end of 1978.

The Department has revised the content of the draft programmatic environmental impact statement in light of the written comments received on that statement and oral comments submitted at the public hearings held in February, 1975. The final OCS programmatic EIS addresses the proposed program as modified in November, 1974, and includes a discussion and analysis of the proposed OCS planning schedule, revised June, 1975. The final statement was submitted to CEQ and made available to federal, state and local agencies, and interested members of the public in July, 1975. On September 29, 1975, the Acting Secretary approved a program to accelerate oil and gas leasing on the Outer Continental Shelf. The Department's decision was made only after conducting in-depth studies based on the best information available considering environmental, technical and economic aspects of the proposal to accelerate OCS leasing.

As in the case of this proposed OCS oil and gas lease sale, the Department has committed itself to prepare a site-specific draft environmental impact statement for each OCS oil and gas lease sale that may be proposed. This is in addition to preparation of the programmatic EIS.

The approved accelerated leasing program that includes proposed sales in the Gulf of Mexico does not constitute a decision on this proposed lease sale. This site-specific proposal will be considered on an individual basis after the waiting period for the final site-specific EIS has expired, and only after the Department has considered the environmental, technical, and economic aspects of this particular lease sale proposal.

In the planning of the accelerated leasing program, a request for comments from all concerned parties on potential OCS oil and gas leasing appeared in the Federal Register in February 1974. The Bureau of Land Management and the Geological Survey reviewed all the responses received and, on the basis of these responses, determined several rankings of the 17 OCS areas, including the Gulf of Mexico, which were delineated in the request. The Central Gulf of Mexico was ranked first in a composite ranking of resource potential and preference. Four petroleum companies also ranked the 17 areas on the basis of environmental hazard. From least to greatest hazard, on a scale of one to ten (ten being greatest hazard), the Central Gulf of Mexico was ranked second.

This request for comments and ranking procedures was the first tier in the two-tier nomination system for OCS leasing, the second procedure being the tract selection process.

## Relationship to Other Governmental Programs

### Federal

#### ADMINISTRATIVE AND REGULATORY RESPONSIBILITIES

As indicated in the Tract Selection Process section leasing procedures and pre-leasing evaluations and analyses are the responsibility of the Department of the Interior—primarily the Bureau of Land Management and the U.S. Geological Survey. The U.S. Fish and Wildlife Service helps design environmental studies and acts in an advisory capacity through much of the leasing process.

Several agencies, including Interior agencies, are involved in regulatory aspects of offshore oil and gas operations which involve their program areas. Offshore structures require permits to assure that navigation is unobstructed by ascertaining that structures are properly marked to protect navigation. These permits are issued by the Department of Defense, Secretary of the Army (Corps of Engineers), and the Department of Transportation (Coast Guard), respectively. Establishment and enforcement of navigational safety regulations is also a responsibility of the Coast Guard. Pipeline safety is regulated by the Office of Pipeline Safety Operations in the Materials Transportation Bureau in the Department of Transportation. The Geological Survey also considers safety features of design specifications in approving pipeline applications. BLM grants the rights-of-way for pipelines through the Federal OCS.

The Federal Power Commission (FPC) and the Interstate Commerce Commission (ICC) regulate pipelines linked to interstate commerce, and the FPC sets the wellhead price of OCS-produced gas.

Permits for and regulation of oil discharges are under the jurisdiction of the Environmental Protection Agency (EPA), by the authority of the Federal Water Pollution Control (FWPC) Act, as amended in 1972. Both the Coast guard and the Geological Survey perform surveillances for oil spills and discharges.

The FWPC Act also provides for a National Oil and Hazardous Substances Pollution Contingency Plan for which EPA and the Departments of Interior, Transportation, and Defense all share responsibility.

OCS Advisory Board: This board was established pursuant to the provisions of the Federal Advisory Committee Act and under the authority of the OCS Lands Act of 1953. The objective of this board is to advise the Department of the Interior in the performance of discretionary functions under the OCS Lands Act. These functions include all aspects of exploration and development of OCS resources, e.g., resource evaluation, environmental assessment, leasing, mitigating of adverse impacts, and development plants. In formulating recommendations the Advisory Board shall, as applicable, request advice from the OCS Environmental Studies Committee (Frizzell, 1975).

The Advisory Board is chaired by the Secretary of the Interior or his designee and membership consists of one representative from the following: State Department, Environmental Protection Agency, Federal Energy Administration, Council on Environmental Quality, and U.S. Department of Commerce, Defense, and Transportation. In addition, one representative from each of the 22 coastal States plus Pennsylvania are members of the board.

OCS Environmental Studies Advisory Committee: The OCS Environmental Studies Advisory Committee was created pursuant to the provisions of the Federal Advisory Committee Act and under the authority of the OCS Lands Act of 1953. This committee advises the Department of the Interior on the design and implementation of studies related to oil and gas exploration and development on the OCS. These studies include baseline data collection, evaluation, monitoring and special studies. The committee will serve as the scientific counterpart of the OCS Advisory Board (Kleppe, 1075a).

The committee is chaired by a Department of the Interior scientist, designated by the Assistant Secretary, Land and Water Resources, and membership consists of one representative each from the Environmental Protection Agency, National Oceanic and Atmospheric Administration, National Science Foundation, the U.S. Coast Guard, U.S. Geological Survey, U.S. Fish and Wildlife Service, and the Bureau of Land Management. In addition, each of the 22 coastal States plus Pennsylvania will have one appointed member on the committee. To achieve a balance of views the Secretary of the Interior can appoint not more than six scientists from the private sector to the committee.

#### Other Federal Activities on the Gulf of Mexico OCS

Principal military use of the Gulf of Mexico OCS is by the Navy. Gunnery, aircraft, missile, and submarine exercises and activities presently take place in this region under the jurisdiction of the Commander, Eastern Sea Frontier. Air National Guard exercises also take place in designated corridors over the OCS.

### State and Local

The Governors of all of the coastal states are represented on the OCS Research Management Advisory Board. Following are discussions of State and local programs and legislation which have a significant effect, or will be affected by OCS activities.

#### Coastal Zone Management

The Coastal Zone Management (CZM) Act of 1972 (P.L. 92-583), administered by the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce, provides grants-in-aid to States for the development and implementation of management programs to control land and water uses in the coastal zone. In order to qualify for implementation monies, a State must develop its management program within three years. The policy which the Act established is aimed at balancing protection of the coastal environment with development and economic interests. The Act also provides for consistency of Federal programs with approved State plans.

While the Act allows individual States much leeway in devising management plans and allocating responsibilities, both among State agencies and to regions and localities, the States themselves must approve the management plans. Therefore, the types of development permitted in the coastal zone, including any that might be associated with offshore oil and gas operations in the event this proposed sale is held, can ultimately be broadly controlled by the States.

### Offshore terminals

Loop Inc., a consortium of six oil companies has proposed the construction of an offshore oil terminal to accommodate supertankers on the Louisiana OCS. They propose to place six single-point moorings in the Grand Isle area, blocks 52, 53, 58 and 59. The proposed lease tract nearest to this area is tract 61 (Mobile South No. 2 N658 E47) approximately 32 km south of the proposed site and 5 km east of the proposed fairway.

Seadock Inc., has proposed construction of an offshore oil terminal to accommodate supertankers on the Texas OCS. The proposed terminal will be located in the Brazos area blocks 430 and 459 and Galveston area blocks 429 and 460. The proposed lease tract nearest to this area is tract 1 (Brazos A-104) approximately 97 km southwest of the proposed site.

# DESCRIPTION OF THE ENVIRONMENT

## Geologic Framework

### General Geology

Comprehensive discussions of the geologic framework of this region can be found in past Environmental Impact Statements:

For East Texas, OCS Sale No. 34, FES 74-14, Vol. 1 pp. 49-61 (USDI, 1974a).
For Louisiana, OCS Sale No. 36, FES 74-41, Vol. 1 pp. 55-83 (USDI, 1974b).
For South Texas, OCS Sale No. 37, FES 74-63, Vol. 1 pp. 61-86 (USDI, 1974c).

The Gulf of Mexico presently represents a subsiding ocean basin partially filled with sediments. The abyssal Gulf is underlain by a simatic (oceanic type) crust. Domes and diapirs, anticlines and faulting in the western Gulf create the greatest geophysical interest from the petroleum standpoint. The occurrence of salt domes has led to the division of the northern Gulf continental shelf into two provinces. To the east of DeSoto Canyon (General Gulf, Visual No. 2) the shelf is composed largely of a thick sequence of carbonate deposits. Although salt domes occur in DeSoto Canyon, the general decrease in the number of domes east of the Mississippi Delta implies that the underlying salt deposits thin eastwardly. High areas in the basement rocks created a barrier to deposition and may have limited the extent of Jurassic salt deposition to the east along the northern Gulf (Antoine, 1972).

Subsidence, sedimentation and erosion have built the submarine topography as depicted in bathymetric maps of the Gulf by Holland (1970) which is the major source of the bathymetry shown on the series of visuals with this Environmental Impact Statement (EIS).

The continental shelf is a gently sloping submarine plain (less than 1°) of varying width forming part of the border of the continent out to a water depth of approximately 148 m, at which point the continental slope begins. The continental slope has a steeper gradient (approaching 5°), extending from the continental shelf to the oceanic depths.

The environment of deposition of the continental shelf sediment is most significant in its relationship to hydrocarbon production. Sediments deposited on the outer shelf and upper slope have the greatest potential for bearing hydrocarbons due to the following:

(1) This is the location where coarser, nearshore sands interfinger with the deeper-water marine shales, thus providing an optimum ratio of sandstone to shale. The shale forms the source-rock which provides the oil and gas and the sandstone provides the reservoir into which the hydrocarbons migrate.

(2) In this environment, the organic material deposited with the fine-grained clays and muds is preserved, and not oxidized as it might be in shallower, more turbulent water.

(3) It is at this location that the increased overburden of the prograding shallow marine deposits over the plastic salt and marine shales initiates salt flow which triggers the growth of salt domes and regional expansion faults thus providing traps for the hydrocarbons.

This environment, therefore, is the optimal one for providing the three ingredients for the successful formation and accumulation of oil and gas: reservoir rock, source beds and traps.

The continental slope in the northwestern Gulf consists of two parts, a relatively steep lower slope which breaks off abruptly along the Sigsbee Scarp and the upper slope (with 1-2° dip) which is characterized by a hummocky topography made up of small domes (seaknolls) and depressions. This upper slope occurs at about the 150 m bathymetric contour which delineates the Outer Continental Shelf—upper slope hinge line.

The structural grain and topography of the slope are controlled primarily by salt tectonics and the hummocks or hilly nature of the upper slope is due to diapiric salt structures. The top of the salt surface is identified on seismic and sparker records as a strong reflector or an envelope of diffraction patterns. Seismic reflection profiles across the continental margin of Louisiana and Texas suggest that most of the topographic "highs" on the upper continental slope are probably associated with salt intrusions or shale diapirs.

### Status of Geologic Mapping in the Gulf of Mexico Area

To gain a better understanding of the geology of the Gulf of Mexico several visual graphics were prepared at a scale of 1:1,000,000 UTM (Universal Transverse Mercator) from a considerable amount of published and unpublished information.

A comparison of salt dome locations and the production trends on Visual No. 2 with the lease status maps (Visual No. 1) will give an overview of areas of success, failure and future potential in the area of the proposed sale. An intercomparison of the bottom sediment (Visual No. 3), geology (Visual No. 2) and undersea features (Visual No. 4) will give the viewer information on the origin and location of fishing banks and unique areas. A comparison of undersea features with the lease status maps will show where prospective areas are in relation to areas requiring special stipulations.

The source of most available data on coastal Texas is the Bureau of Economic Geology, University of Texas. This group, under the direction of Dr. W. L. Fisher (see Bureau of Economic Geology Annual Reports 1972 thru 1975) has compiled environmental geologic maps at a scale of 1:24,000 for the seven coastal areas of Texas covering a strip of the coastal zone approximately 80 kilometers wide. These maps include the areas from 16 to 24 km offshore and 56 to 64 km onshore. These maps are published as regional maps at a scale of 1:125,000.

The geologic information used for Visual No. 2 was taken from several generalized sources including:

Geologic Map of Louisiana by R. J. LeBlanc, 1948
Geologic Map Coastal Louisiana by D. E. Frazier, 1967
Geologic Map of Mississippi by Miss. Geological Survey, 1969
Geologic Map of Baldwin County, Alabama, P. C. Reed, 1971
Tectonic Map of Louisiana, Pl. II, Lafayette Geological Soc. 1973
Production Trend Map Pl. I, Lafayette Geological Soc. 1973
Production Trend Map of Gulf, USGS, Metairie, La. 1974
Oil & Gas Map of Louisiana, La. Geological Survey, 1973
AAPG Tectonic Map, Gulf Coast, 1972
GSA Bull. Vol. 83, Wilhelm & Ewing, 1972
AAPG—U.S. Geological Highway Map (Texas), H. B. Renfro, 1973
Offshore Louisiana Oil & Gas Fields, Lafayette Geological Survey, 1970
AAPG bathymetric Map, Gulf of Mexico, W. C. Holland, 1970
Geologic Map of Louisiana, Busch et al., 1974
Physiographic Overview of South Louisiana, 1972
Atlas Inventory of Basic Environmental Data
U.S. Dept. of the Army, 1972
Subsurface Fault and Salt Dome Map, Environmental Atlas for South Central Louisiana, Gagliano, et al., 1973
Geologic Map of Florida, Vernon and Puri, 1964

It should be noted that Louisiana is particularly in need of a modern compilation of coastal Geology. Busch et al. (1974) have compiled a physiographic map of the Atchafalaya Basin and a portion of the lower Red River Valley. Another study for south-central Louisiana is the Corps of Engineers-Sea Grant Study, by Gagliano et al. (1973).

**Geologic Hazards**

A number of important geologic hazards occur in the offshore Gulf of Mexico. In the Texas offshore area the possibility of blowouts exists due to the presence of shallow (about 328 m depth) gas deposits within the sediments. Deeper high pressure zones can also cause blowouts during the drilling operation. A third hazard is a soft plastic sea floor laced with surficial faults which can present unstable foundations for rigs. A fourth hazard can occur in rough sea floor conditions where coral heads, sharp reefs and structural troughs occur. Damage to the rig in areas of poorly described roughness can occur by jamming the legs or having legs slip off rough surfaces. The problem of locating rigs on a soft plastic sea floor is compounded in offshore Louisiana along the steeper slopes of the Mississippi River delta primarily off Main, South and Southwest Passes (Fig. A-1).

SUBSIDENCE

The apparent rise in sea level and/or land subsidence is a hazard along the low coastal lands of Texas and Louisiana.

Along the coastal lands subsidence can not easily be separated from the effects of the rise in sea level because either action allows encroachment of the ocean. Causes of the rise in sea level are generally attributed to the melting of glaciers and polar icecaps.

Land subsidence is generally attributed to extensive pumping of ground water and petroleum which causes a decline in the piezometric pressure in the porous rocks allowing once saturated beds to compress. Subsidence can also occur from sand and sulphur pumping and tunnel mining, however, this is rare in the areas under consideration.

National Ocean Survey (NOS-NOAA) has maintained tide gauges and sea level data in the Gulf for many years. Data on three long term stations are shown below.

| Site | Years monitored | Sea level change (meters) |
|---|---|---|
| Pensacola, Fla. | 47 | 0.16 |
| St. Charles, La. | 31 | 0.39 |
| Galveston, Tex. | 62 | 0.43 |

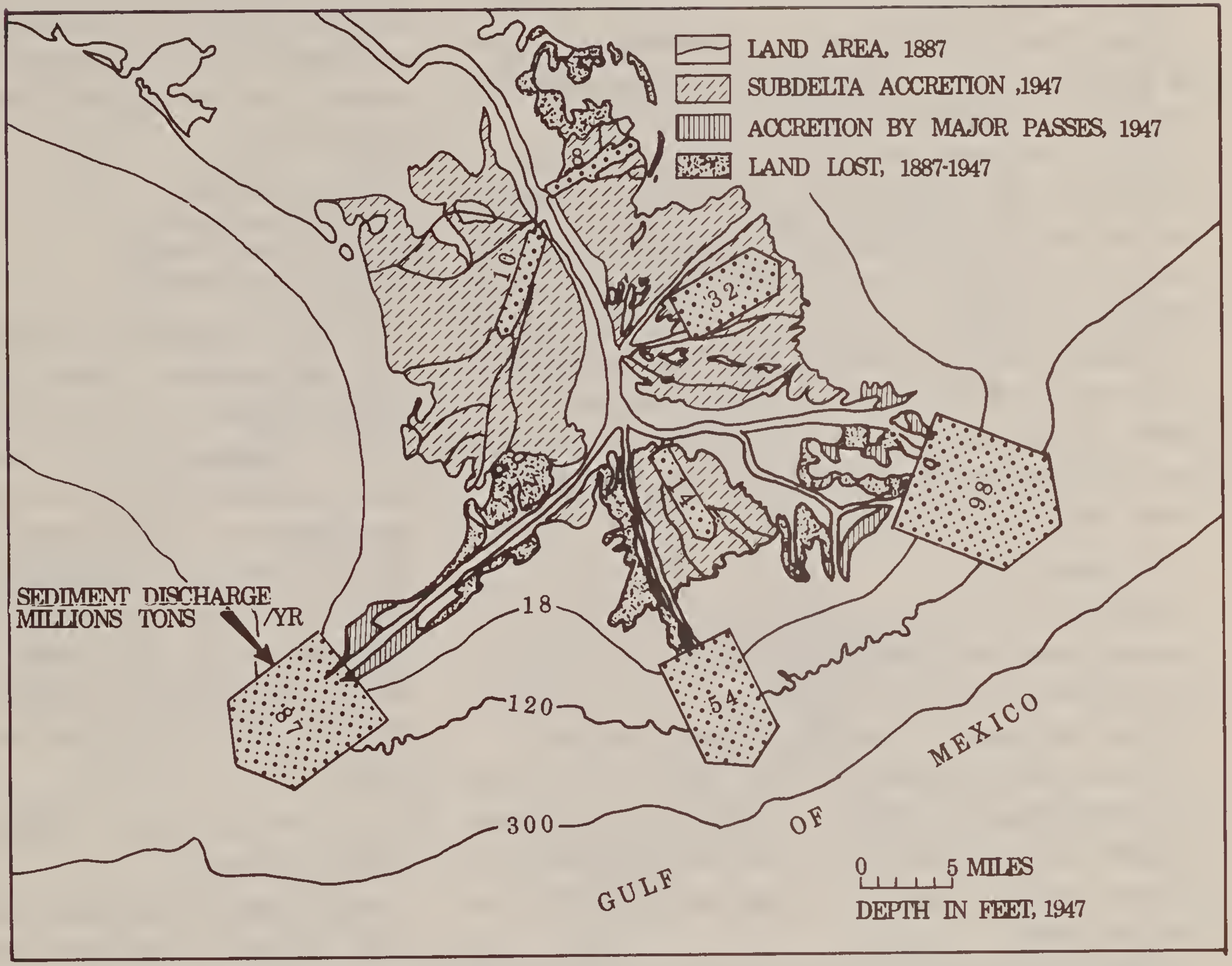


Figure A-1 Relative sediment discharge and land accretion in the active birdfoot delta of the Mississippi River.

The pumping of large amounts of ground water in the Houston-Galveston region, Texas, has resulted in water-level declines of as much as 61 m in wells completed in the Chicot aquifer and as much as 99 m in wells completed in the Evangeline aquifer during 1943-73. The maximum average annual rates of decline of 1943-73 were 2.0 m in the Chicot aquifer and 3.3 m in the Evangeline aquifer. During 1964-73, the maximum rates were 3.0 m in the Chicot and 5.4 m in the Evangeline. The declines in artesian pressures have resulted in pronounced regional subsidence of the land surface.

The center of subsidence is at Pasadena, where as much as 2.3 m of subsidence occurred between 1943 and 1973 (Figure A-2).

In the southern part of Harris County, about 55 percent of the subsidence is a result of compaction in the Chicot aquifer. The area in which subsidence is 0.3 m or more has increased from about 906 km² in 1973.

Planned use of surface water instead of ground water will probably result in some recovery of artesian pressures. If pressure recovery occurs the rate of subsidence should decrease substantially in the more critical areas.

### MUD SLIDES

Recent studies of mud slide hazards in the Mississippi Delta were conducted by the U.S. Geological Survey with the cooperation of the Coastal Studies Institute of Louisiana State University.

Figure A-3 delineates areas within which adverse foundation conditions can exist. It has been possible to cope with some areas of unstable conditions through extensive engineering design on the platforms.

Relatively rapid sediment movement can occur both in the lateral and vertical directions placing a structure in critical trouble. These movements, which may cover larger areas, pose a type of hazard to sea floor structures which is analagous to that posed by landslides to structures onshore, except that offshore they may occur on slopes which are almost negligible.

Some of the pioneering work in this field by Shell Oil Company suggests that in some cases fluctuating pressures within the upper 32 m of sediment caused by storm waves may trigger a sediment failure. Other investigations conducted at the Coastal Studies Institute indicate that the content of dissolved and undissolved gases in sediments may play an important role in their instability.

### EARTHQUAKES

Of lesser importance in the Gulf of Mexico is the risk from earthquakes. No known damage has been recorded from earthquakes on an offshore oil platform or installation in the Gulf of Mexico.

Seismic risk areas were originally designated for all parts of the United States in 1947 by the Coast and Geodetic Survey and revised several times since then. Seismic risk is expressed in arbitrary numbers from 0 to 3. They are based on historical data considering only the intensity of an earthquake, not the frequency of occurrence, and express the anticipated damage that would occur in that area.

Zone 0—No damage
Zone 1—Minor damage
Zone 2—Moderate damage
Zone 3—Major damage

In the western Gulf of Mexico, seismic risk is zero (Algermissen, 1969). This appears to be a rather unique area due to the lack of seismicity. No earthquakes of any notable intensity have been recorded for this area and only two earthquakes of notable intensity have occurred in the Gulf near this area; one north of Vera Cruz, Mexico and one southeast of the leasing area in over 600 m of water near 93° W and 27°30′ N. Neither of these earthquakes produced damaging tsunamis and neither were considered well located events.

### FAULT DISPLACEMENT, HYDROCARBON SEEPS AND SEEP MOUNDS

Active faults, gas seep areas and seep mounds pose dangers to offshore seabottom operations, however these hazards are some of the most obvious anomalies recorded by geophysical surveys for bottom hazards. Active faults in hydrocarbon producing areas such as the vast salt dome province in offshore Louisiana (Central Gulf, Visual No. 2) are generally associated with hydrocarbon seeps (normally gas seeps) and unstable seep mound areas which can often grow to heights of more than 16 m. Areas underlain by salt domes, such as the Flower Garden Banks, Claypile and Stetson Banks (Western Gulf, Visual Nos. 2 & 4) are typical areas where active faults, gas seeps and seep mounds have been surveyed. Since these features are notable on side-scan and high-resolution seismic data, these survey

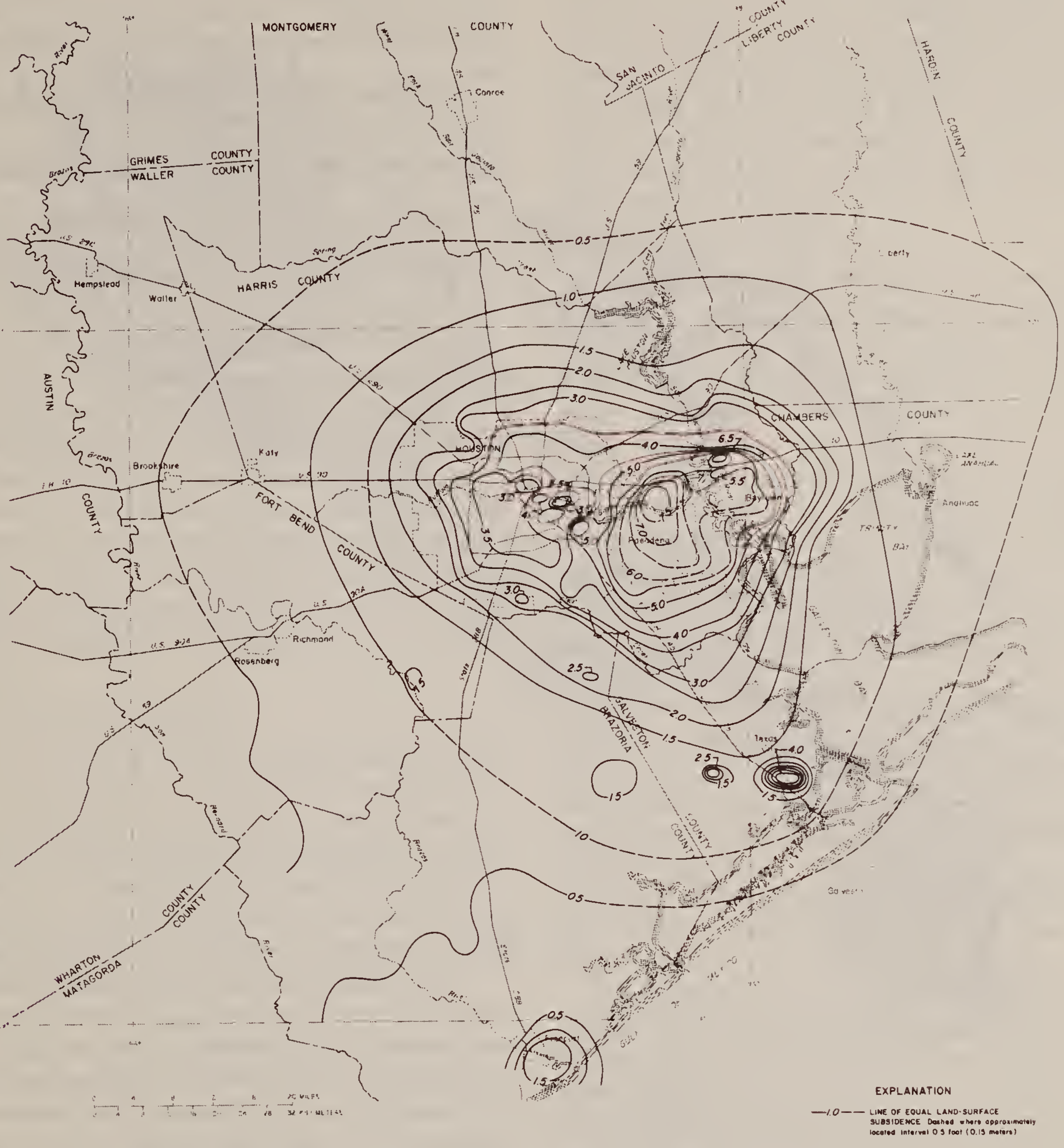


Figure A-2

Subsidence of the Land Surface, 1943-1973

**AFTER R.K. GABRYSCH & C.W. BONNET,(1975).**

Base from Texas Highway Department county highway maps.

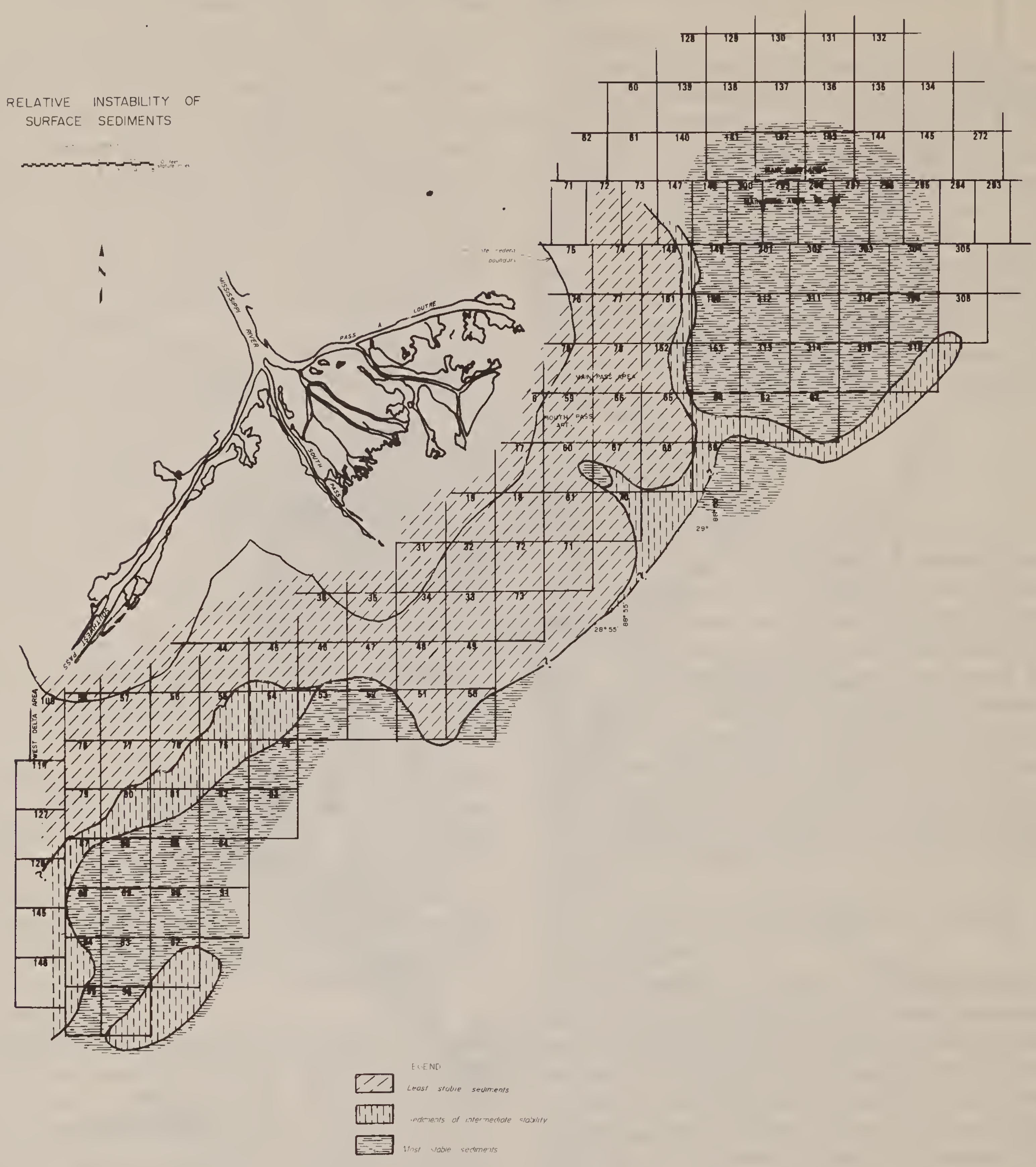


FIG.A–3 MAP SHOWING ZONES OF RELATIVE BOTTOM SEDIMENT STABILITY. (U.S. GEOLOGICAL SURVEY,1974.)

techniques are routinely used to locate these hazards.

Active fault displacements, gas seeps and seep mounds are generally considered an order of magnitude less hazardous than gas charged sediments and high pressure gas zones due to the recognizability of these former features on survey records. Gas charged sediments, high pressure gas zones and gas saturated sediments in delta areas are significant potential hazards however. Although geophysical techniques cannot detect high pressure zones directly, processed survey data frequently reveal velocity and amplitude anomalies which appear to correlate with the geopressured zones.

### BATHYMETRIC PROMINENCES AND STEEP SLOPES

Rough sea floor conditions where coral growth, reef scarps and troughs occur can be hazardous to pipeline installations and installations of offshore platforms. Shipwrecks and large artificial reefs must also be avoided as obstructions in place as well as a movable hazard if the area is disturbed by high currents and bottom instability during hurricanes. These problem areas can be located by modern geophysical equipment used in hazard surveys.

### RATING OF THE HAZARDS

It is not entirely realistic to rate hazards since they vary greatly in areal extent, magnitude, intensity, chance of occurrence and degree of mitigation. Each hazard must be studied on a case by case basis in each particular area. However, an attempt to rate the hazards in this region for offshore pipeline and platform installation with these qualifications is presented in Table A-1.

During its review of applications to drill, the USGS informs the applicant of all current data concerning geologic hazards in the proposed area of operations, and requires that the applicant submit an operation plan which outlines procedures intended to deal with these hazards.

### Bottom Sediments

Sedimentation in the Gulf of Mexico has been complicated by transgression and regression of the shoreline in response to changes in sea level and/or tectonic movement of the adjacent land mass or sea bed. The overall pattern of deposition is one of regression interrupted by minor transgressions. The result of this is a sequence of continental, deltaic or paralic, and shallow water sandstones, siltstones, and shales being progressively built-out over marine deposits. At various times in the geologic past, particularly in the Late Tertiary, sea level has been lowered or raised in response to increased or decreased glaciation. This has tended to upset the normal progradation of the shoreline, but at the same time it created extensive salt marsh areas on the now submerged continental shelf. Decay of buried organic matter from brackish water marshes are thought to be the primary source of the hydrocarbons found on the continental shelf.

### Bottom Sediments

The Mississippi Fan dominates the north central Gulf region of the Gulf of Mexico (Central Gulf, Visual No. 2). This thick accumulation of primarily Quaternary alluvium extends over a 414,400 square kilometers area including parts of the shelf, slope, rise and abyssal floor. Bottom gradients range from two degrees near the apex to about 0.3° at the outer margin more than 644 km to the southeast. Within this slope regime the greatest change in gradient occurs roughly at the 2,500 meter isobath and arbitrarily divides the fan into upper and lower segments (Huang and Goodell, 1970).

Historically, the site of active deltaic build-up along the Louisiana coast has shifted several times during the past million years. Kolb and van Lopik (1966) identified at least seven subdeltas of the Mississippi Delta complex. The river's modern ''birds-foot'' delta, the Balize Lobe, extends underwater almost to the continental slope and represents the uppermost part of the Mississippi Fan.

The Mississippi Fan and major portions of the abyssal plain and continental rise contain sediments that were transported in part by turbidity currents and in part deposited pelagically. Sediments in these areas have been derived from the northern and western shelves and slopes; however, the bulk has been derived from the Mississippi Delta. The midwestern and southwestern Gulf have sediments that are more pelagic in origin. Their carbonate content is high and is made up in major part by foraminifera tests. A low accumulation rate is assumed for this area based on the observed high degree of bioturbation.

Sediment maps for the Gulf of Mexico (Visual No. 3) have been compiled principally from a map

Table A-1 HAZARDS ARE LISTED WITH A PROPOSED RATING OF GREATER TO LESSER DEGREE

| Hazard | Ease of Identification | Ease of Mitigation |
|---|---|---|
| Unstable bottom, steep slopes, gas charged, hurricane triggered | Yes<br>(Mud slide areas) | No (hazardous to pipelines) extensive pilings for platform strength |
| Unstable bottom, steep slopes, gas chaged, gravity triggered | Yes<br>(Mud slide areas) | Same as above |
| Gas charged or geopressured zones | Variable | No (blowout preventers) semi-submersible or drillship are safer than platforms |
| Fault displacement, gas seeps and mounds | Yes<br>Geophysical surveys | Yes (moving off - directional drilling) |
| Rough sea floor, shipwrecks | Yes<br>Geophysical surveys | Yes (moving off - directional drilling) |
| Karst topography | Yes<br>Geophysical surveys | Variable |
| Earthquakes | No<br>After the fact | Variable - affects coastal zone |
| Subsidence | Variable | Variable - affects coastal zone |

by John Grady (1970). Additions to John Grady's data have been made principally in the location of hard banks, coral banks, gravel and shell areas taken from other sources such as commercial fishing bank maps, industry surveys and personal communications with university researchers, sports and commercial fishermen.

Localized sediment maps for the areas south of Timbalier Bay to Grand Isle (Gulf Universities' Research Consortium, 1974) and Mississippi Sound (from Eleuterius, 1974) contain detailed information useful as a supplement to the regional sediment map by Grady (1970).

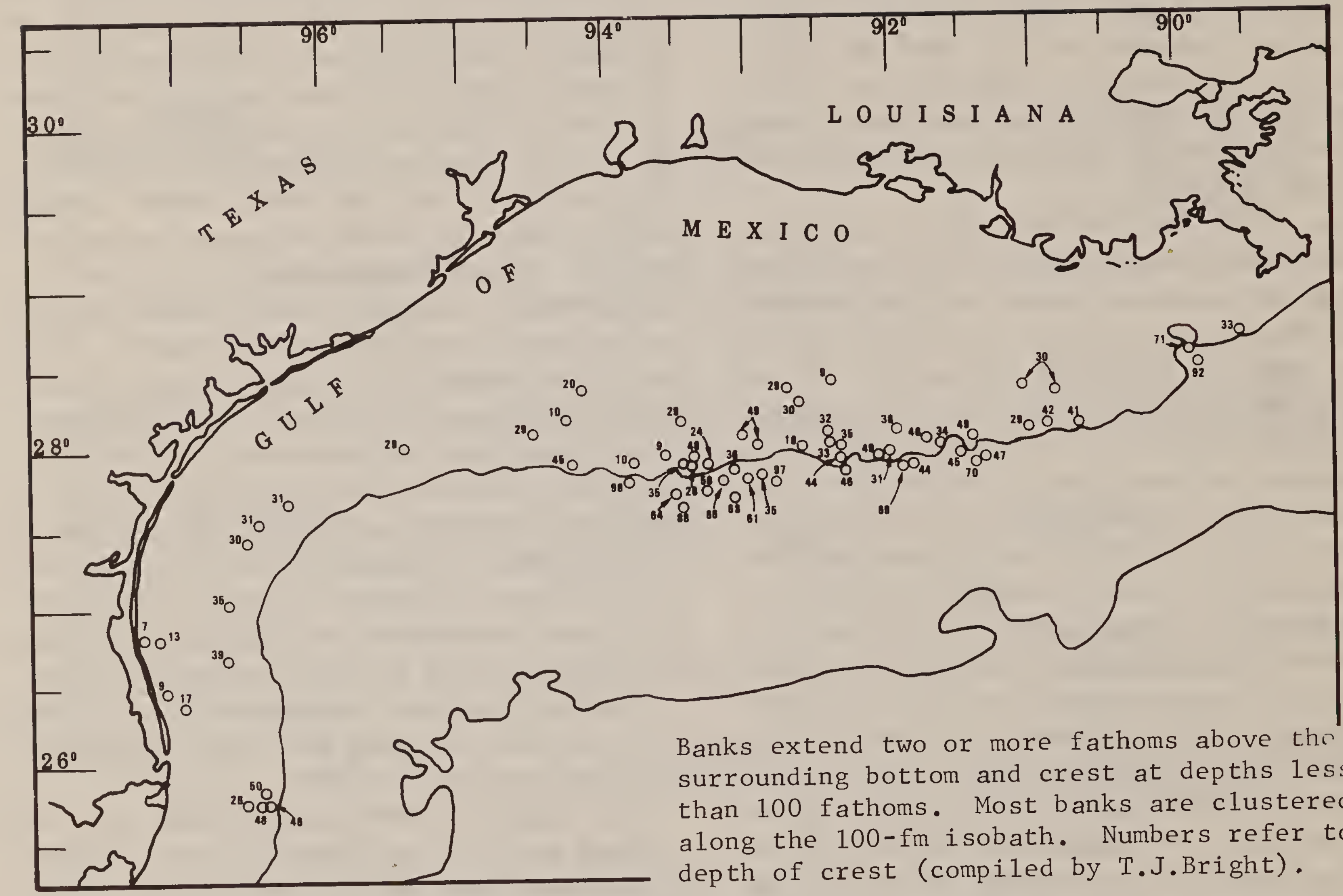
According to Curray (1960) and Shepard (1960), the surface sediments of the shelf are mainly Holocene or Pleistocene in age and are products of the marine transgression (depositions during the rise and fall of the sea level) following the Wisconsin glaciation.

From the Rio Grande River northward, Holocene sediments are generally thin and thicken only at the mouths of rivers with the particular thickening of over 115 m in the Mississippi Delta area. Holocene sediments (Visual No. 3) are usually unconsolidated along the bays, estuaries and shoreline of Texas in comparison to the Pleistocene sediments. The top of the Pleistocene in some areas is recognizable on high resolution seismic records. Sea floor composition from Port Isabel to Port Aransas is generally silty clays with sand zones near shore and some sizable areas of shell and silt particularly in Corpus Christi, Galveston and Aransas Bays. From Port Aransas to the Texas-Louisiana boundary the sediment zones become more varied with longer zones of sand and silty sand with less silty clay present. Part of this increased complexity may be due to the general increase in the number of samples that were collected. Few areas of gravel exist, however, and dredging of shell has a commercial value in Texas state waters. Sediment deposits in the southern area have the unique characteristic of alternating bands of coarse and fine sediments paralleling the coast (Curray, 1960). The coarse sediments are presumed to be relict shallow water deposits whereas the finer sediments are Holocene shelf deposits. Four depositional zones can be recognized in the northeast Texas OCS area. Zone One consists of layered sand from the beachline to the forty foot depth; Zone Two consists of alternating thin layers of sand and mud of irregular widths; Zone Three consists of mud flat deposits with shell banks and shallow water faunal remains and Zone Four consists of homogeneous clays and silts with deeper water faunal forms.

A number of undersea features are shown in Visual Nos. 3 & 4. Many of these features are known to have unusual or notable sedimentary conditions and are generally regarded as preferred fishing areas or banks. Names of most of these features are of local use and have no official federal acceptance. Visual No. 4 shows approximate locations of shipwrecks which could also have archaeological significance as well as fish havens, fishing banks, rocks, holes and reefs. In the western Gulf of Mexico a striking number of banks are considered snapper and grouper fishing areas and usually prove to have been caused by the upward thrusting of piercement salt domes. The origin of East and West Flower Garden Banks is the joint growth of upward moving salt plugs and the reef building coral.

The bank which has been studied to the greatest extent is the West Flower Garden. A report "The Geology of the West Flower Garden Bank" by Edwards (1971), gives a complete history of studies there. A recent study by several investigators discussed the geology, geochemistry, sediment distribution and biology of a portion of the bank under the auspices of the Flower Garden Ocean Research Center (FGORC) during 1972. This study concentrated on the high part of the bank in the area of the living reef building coral. A wealth of excellent photographs and valuable data was collected during these research missions by Bright & Pequegnat (1974).

The origin of other major banks has not received as extensive research; however, Stetson Bank appears most like the Flower Garden Banks (Bright & Pequegnat, 1974). As exploration in this part of the Gulf continues, many new unique bathymetric features are being discovered. Figure A-4 compiled by Bright (1974), shows over sixty such banks, with most of them clustered along the 183 meter depth contour offshore of western Louisiana and eastern Texas. This alignment also coincides with the Pleistocene gas deposit trend along the edge of the shelf. Major petroleum interest is being devoted to these areas and additional study of these areas seems inevitable. Detailed maps of fishing banks shown in western Gulf, Visual No. 4 have been prepared by Texas A & M University and DECCA Surveys, and are



Banks extend two or more fathoms above the surrounding bottom and crest at depths less than 100 fathoms. Most banks are clustered along the 100-fm isobath. Numbers refer to depth of crest (compiled by T.J.Bright).

Figure A-4 Distribution of Submarine Banks in the NW Gulf available in their report of Texas fishing banks to the Bureau of Land Management, New Orleans.

Various alignments of banks are obvious along the Texas coast. It is presumed that the alignment of these banks constitutes a record of ancient shorelines (Curray, 1960). Many of these banks were the result of a nearshore environment; hence, the oyster, clam and other shell deposits. In other cases, lagoonal mud deposits and nearshore beach strands have been preserved. In most cases, these banks were presumed to have developed during the Pleistocene and Holocene; however, research of many of these features has been either cursory or nonexistent. Many banks probably existed during various stands of sea level in late Pleistocene where shell growth or calcareous cementation of sediments occurred. This condition could have occurred out to the present 100 m water depth (Fig. A-5). As the beach lines migrated due to changes in sea level, the unconsolidated barrier deposits or topographic highs along the beaches were destroyed and reworked; leaving the shell beds, cemented sands and clays as bathymetric highs due to their resistance to erosion.

The Alaminos, Old Mississippi and DeSoto Canyons are inactive canyons in which the upper part of the sediment column does not reveal typical submarine canyon characteristics but a rather homogeneous ooze type sediment as filling.

Relief features associated with the shelf edge and slope have been reported by Uchupi (1967), and Bergantino (1971), (General Gulf, Visual No. 1).

**Petroleum Geology**

The most prominent structural anomalies in the northwestern Gulf are salt domes (Central Gulf, Visual No. 2) and a series of regional, down-to-the-Gulf faults which have materially affected sedimentation across them. Less common are deep seated, low-relief up-lifts and shale domes (Western Gulf, Visual No. 2). These structural features are related to the presence of an underlying salt basin and the Cenozoic sedimentary wedge which has gradually advanced seaward across it.

The abundant salt dome structures around which most of the oil pools off East Texas and Louisiana have formed are rare off South Texas. Although salt is thought to be present at depth, it has not formed diapirs so freely for reasons not well understood. Large salt structures are present in deeper water near the base of the slope, but they are not structurally similar to the piercement domes to the northeast, and their trapping capabilities are not known. Several large, linear deep-seated anticlinal structures are present near the mid-shelf area but little can be said of their origin on the basis of available seismic records. In the coastal area from Corpus Christi to Matagorda Bay, a number of domes with cores of shale are present. Their extent is not fully known, but hydrocarbon production has been obtained from at least a few.

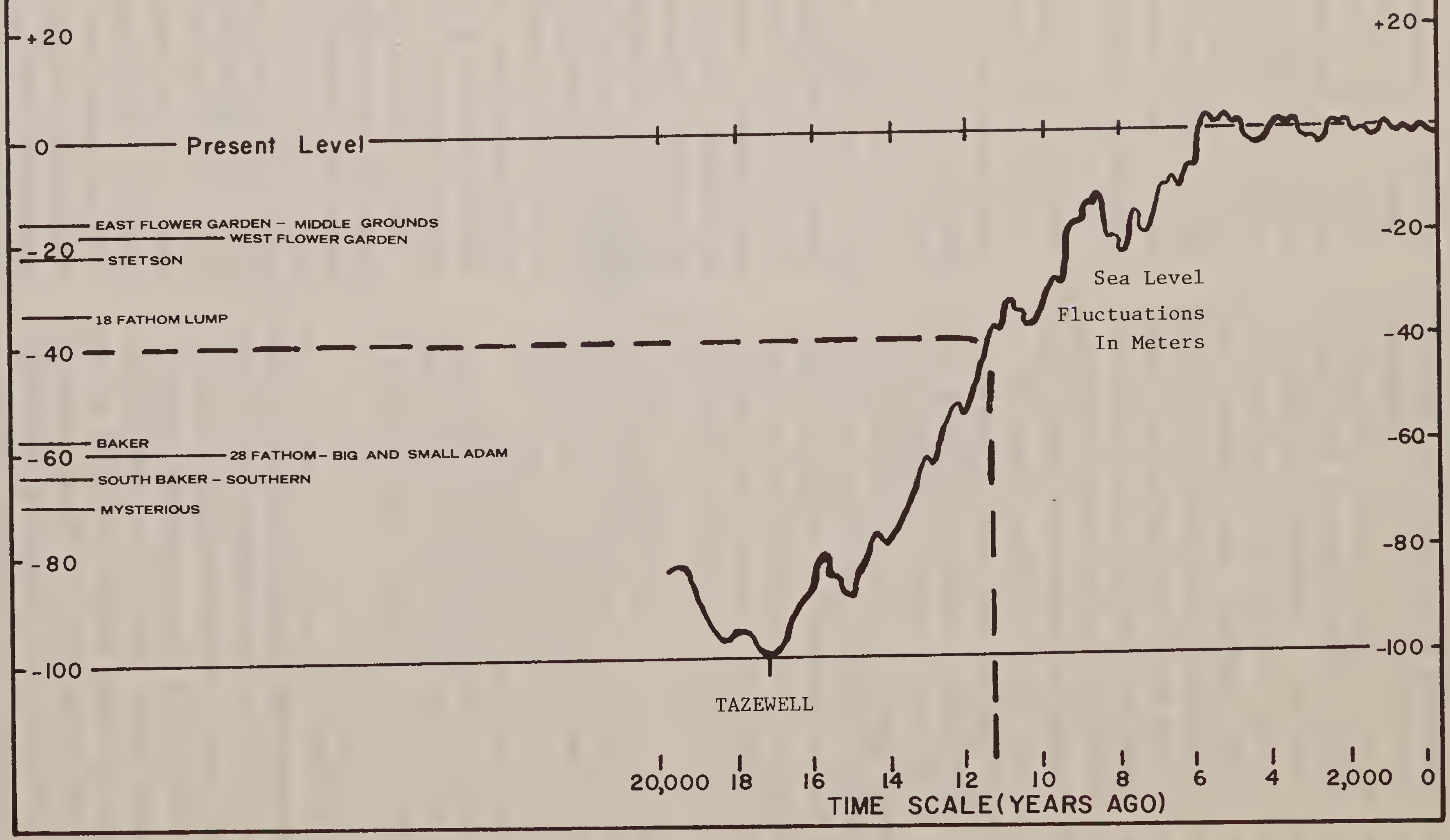
A series of regional faults commonly called ‘‘growth faults’’ are present in the Texas-Louisiana subsurface. They are aligned approximately parallel to the coast. These are normal faults, long and arcuate in the horizontal plane, with large amounts of vertical displacement downwards into the coastal basin. Rock units commonly show greater thicknesses on the downthrown sides of these faults, thus fault movement and deposition must have been essentially contemporaneous. The downthrown section acted as a topographic depression for localized deposition.

A veneer of Miocene and Pliocene overlain by a thicker section of Pleistocene sediments derived from the Mississippi River system were supplied to the offshore Louisiana area. The Texas shelf, at the same time, received smaller volumes of sediment because it was on the western border of the Mississippi River depocenter.

Since natural production of oil and gas frequently occurs along the continental shelf-slope break, the progradation of the north-central Gulf depositional regime has resulted in the migration of this production zone seaward, developing a series of progressively younger bands of trends. Central Gulf and Western Gulf, Visual No. 2, shows the Late Tertiary and Quaternary production trends which underlie this area.

Future production from the upper slope area, in water depths varying between 200 to 600 m, is conjectural. There is not much deep subsurface information available for the Continental Slope. Information about this area is largely derived from seismic data bathymetry studies, shallow cores (less than 305 m deep) and a few exploratory wells off the Mississippi Delta. The prospective horizons of the upper slope of offshore Texas should consist of a veneer of Miocene and Pliocene with a thick interval of Pleistocene. The

Figure **A-5** The Rise and Fall of Sea Level Following the Wisconsin Glaciation (From R. W. Fairbridge, 1960)



Pleistocene sediments are considered the most prospective reservoir beds. The thickness of these deposits on the slope is variable but is at least 32-80 m. Some discoveries have recently been made in the deepwater area off the Mississippi Delta. How far down dip prospective sections extend, both in Louisana and Texas deepwater areas, is not known.

Basinal areas between salt structures on the upper slope contain a considerable amount of sediments, most of which appear to be muddy slump deposits with infrequent turbidite sand zones (Martin, 1973, Lehner, 1969). Powell and Woodbury (1971) speculated that turbidite sands of reservoir quality could conceivably be present on the upper slope, especially in deposits of Pleistocene Age, which were derived from inner shelf areas deposited during glacial epochs when the sea level was lower and shoreline was close to the present shelf edge.

There are approximately 366 fields on the Federal OCS of the Gulf of Mexico. Of these, 232 primarily produce gas and 94 primarily produce oil. Production depths range from about 328 m to 9515 m, with most production occurring between 2625 and 3938 m. USGS records show that 3.613 billion barrels of oil and condensate and 0.68 trillion cubic meters of gas have been produced from Federal OCS lands as of January 1, 1975.

The most prolific offshore production comes from the Miocene of the eastern Louisiana OCS. This area, as currently defined, has more oil than the remainder of the Texas-Louisiana area. The next most productive trend is the Pliocene trend of central Louisiana OCS which produced about 50% oil and 50% gas. Further to the west this producing trend dies out. The Miocene of western Louisiana is the third most productive trend producing mostly gas, and the Pleistocene of offshore western Louisiana ranks fourth.

The prospective horizons of the upper slope of offshore Texas should consist of a veneer of Miocene and Pliocene with intervals of Pleistocene. The Pleistocene sediments are considered the most prospective reservoir beds. The thickness of these deposits on the slope is variable but is at least 32-80 m.

The clastic sediments derived from the ancestral Mississippi River system have built out as deltaic deposits in the Gulf. The prospective sediments underlying the Texas-Louisiana shelf are those of Oligocene, Miocene, Pliocene and Pleistocene Age.

### OLIGOCENE SEDIMENTS

The Frio Formation is the most prolific oil and gas producer in south Texas. About 90% of the hydrocarbon reserves in south Texas are found in this formation.

The prospective Frio section thickens seaward from a few hundred meters to more than 2000 m. Regional structural maps indicate that a drilling depth of 4920 or more will be required to test the prospective section in offshore south Texas areas.

### MIOCENE SEDIMENTS

The Miocene trend is less prospective in Texas compared to offshore Louisiana. At the end of Oligocene time, the depocenters for continental-derived sediments shifted eastward, and the Mississippi River system brought to this rapidly subsiding area great quantities of sand, silt and shale. Much of this sediment was deposited in deltas and considerable amounts of clay and silt were carried by longshore currents to the innerdeltaic offshore area farther west. During early Miocene, the area of maximum sedimentation was located in southwest Louisiana but gradually shifted to southeast Louisiana, later Miocene. The Miocene section of southeast Louisiana is the thickest in the Gulf Coast Province. Small rivers (Rio Grande, Nueces, Colorado, Brazos, Trinity and Sabine) did transport a considerable amount of sediment to offshore Texas, but they did not construct deltas of the magnitude of the Mississippi Delta. The sands that reached the sea were distributed laterally by longshore currents and formed various islands by wave actions. The finer sediments were deposited in lagoons, bays, coastal marshes and in the neritic zone. The Colorado-Brazos River system did build several large deltas during Lower Miocene time when the area north of the Balcones fault zone in central Texas was uplifted and became an important source for sediments. The largest Colorado-Brazos delta is located shoreward of East Breaks Canyon (Western Gulf, Visual No. 4).

### PLIOCENE SEDIMENTS

The Pliocene production in offshore Texas has been of little importance compared with that of Louisiana. Pliocene time was a period of uplift and erosion and the sediments that accumulated in the Gulf of Mexico or that were deposited in the coastal environment are, generally, seaward of the present shoreline. The area of maximum sedimentation in Pliocene time was located off the coast of southeast Louisiana. Much of Pliocene production is confined to the central and southeast Louisiana OCS area. Offshore Texas, two distinct provinces are indicated to exist in the Pliocene Trend. One province occurs in the Texas offshore area south of the San Marcos Arch. Sediments there are expected to contain sand derived from the Rio Grande River and associated rivers to the north. The other Pliocene province occurs in the eastern portion of the Texas offshore and continues into the East and West Cameron areas offshore Louisiana. This province is dominated by salt domes and deep-seated diapirs. The stratigraphic sections in offshore Texas, however, are much thinner than in offshore Louisiana, and exploratory results to date in this province have proved discouraging.

### PLEISTOCENE SEDIMENTS

Two Pleistocene provinces are indicated in the offshore Louisiana-Texas region. The first Pleistocene province occurs from the Ship Shoal area off Louisiana to the southern portion of the Galveston area offshore Texas. This province has a thick sequence of Pleistocene sediments with favorable stratigraphic conditions for both the generation and entrapment of hydrocarbons in porous rock, and structurally is characterized by salt domes and deeper-seated shale domes and ridges. The trend area, to the east (in West Cameron), is presently being developed as a gas producing province. Several fairly large gas fields have been found, some with associated condensate and oil reservoirs. Also, several wells are now being drilled in acreage offshore Texas High Island area which was leased in June 1973, East Texas Sale No. 34. The potential of this province is generally regarded as being very good.

The second province occurs offshore southwest Texas, and generally is made up of the Pleistocene offshore delta of the Rio Grande River. The Rio Grande built a subaqueous delta which prograded across the continental shelf and continental slope. The Pleistocene sediments are typified by a fairly sizable quantity of sand deposited under dominantly marine conditions, with interbedded deposits of continental sand material.

## Climate

### Surface Wind Patterns

The Azores-Bermuda atmospheric high pressure cell dominates the circulation over the Gulf, particularly during the spring and summer months. In late summer there is a general northward shift of the circulation and the Gulf comes under the more direct influence of the equatorial low pressure belt. During the relatively constant summer conditions, the southerly position of the Azores-Bermuda cell brings about predominance of south-easterly winds. The winds tend to become more southerly in the northern part of the Gulf. During the winter, winds usually blow from easterly directions with fewer southerlies but more northerlies. Winds from west and southwest are rare anytime during the year.

Sea surface currents in this area are generally weak and variable being largely determined by the winds. Wind driven currents are very complex with their velocities depending upon the speed, direction and duration of the wind as well as the orientation of the coastline and certain bottom characteristics.

Near the coast winds are more variable than over the open waters because the coastal winds fall more directly under the influence of the moving cyclonic storms that are characteristic of the continent.

### Air Temperatures

Average temperatures at coastal locations vary with latitude and exposure. In winter they depend on the frequency and intensity of penetration by polar air masses from the north. These incursions, when they bring strong northerly winds, are called ''northers'' and may occur some 15 to 20 times between November through March.

Air temperatures over the open Gulf exhibit narrower limits of variation both on a daily and seasonal basis (Fig. B-1). In July, average temperature over the center of the Gulf is about 29° C and gradually increases coastward to within 3° C of temperatures recorded at coastal localities. East of Brownsville and Corpus Christi, Texas, January air temperatures over the open Gulf average about 18° C. The mean annual surface water temperature for the Gulf is 25° C (Leipper, 1954a).

### Precipitation

Average annual precipitation along the Gulf coast increases from approximately 69 cm at Brownsville to over 102 cm at Galveston, and (137 cm) at New Orleans. Rainfall is fairly evenly distributed throughout the year but does show distinct seasonal variations, with the greatest amounts occurring during the months when the winds are predominantly out of the southeast and south, namely June, July and August.

Along the central Gulf precipitation is frequent and abundant throughout the year. At New Orleans, October is the only month with a precipitation average less than 8 centimeters. July, the wettest month, receives just under 18 cm. Stations along the entire coast record the highest precipitation values during the warmer months of the year. The month of maximum rainfall for most locations is July, however, at Brownsville the record maximum is in September. Winter rains are associated with the frequent passage of frontal systems through the area. Rainfalls are generally slow, steady and relatively continous, often lasting several days. Snowfalls are rare, and when frozen precipitation does occur it usually melts upon contact with the ground. Incidence of frozen precipitation decreases with distance offshore and rapidly reaches zero.

The warmer months usually have convective cloud systems which produce showers and thunderstorms; however, thunderstorms of this type rarely cause any damage or have attendant hail. Tornadoes and waterspouts are also rare in this area (Brower, et al., 1972).

### Sky Cover and Visibility

#### CLOUDINESS

Along the Gulf coast cloudiness averages between 0.5 to 0.6 sky cover with relatively small seasonal variation. October is generally the clearest month and December through March the cloudiest. The Climatic Atlas of the U.S. (U.S. Dept. Commerce, 1968) shows that the central Gulf Coast received the highest percentage of possible sunshine in the summer and fall, ranging between sixty and seventy percent, with the high in October. The percentage of possible sunshine declines to a low in December and January (fifty percent or less) and increases gradually through the spring and early summer into the sixty percent range (Table B-1).

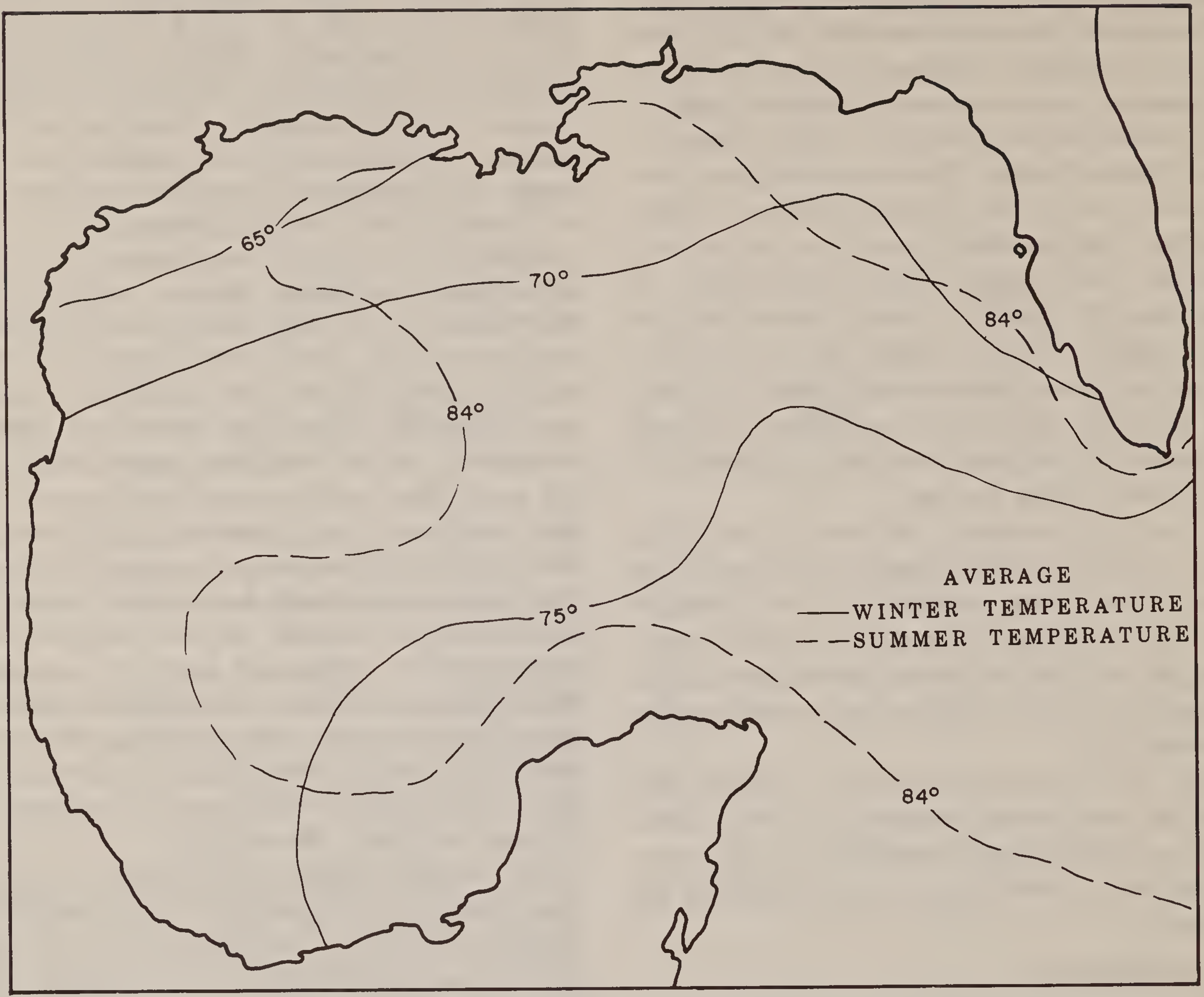


Figure B-1. Average summer and winter surface air temperatures in °F for the Gulf of Mexico (Leipper, 1954a).

During the warm season, May through September, cumulus clouds begin developing over northern Gulf waters about 0300 hours and the larger clouds may produce scattered showers which dissipate when carried onshore during the morning by the sea breeze. Onshore cumulus development occurs during the day reaching maximum in late afternoon, often accompanied by rainfall (Orton, 1964). Much of the summer clouds are either convective cumuli or high, relatively transparent clouds (Brower, et al., 1972).

TABLE B–1.—*Percentage of possible sunshine*
New Orleans, La.

| Jan | Feb | Mar | Apr | May | Jun | July |
|---|---|---|---|---|---|---|
| 49 | 50 | 57 | 63 | 66 | 64 | 58 |
| **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Annual** | |
| 60 | 64 | 70 | 60 | 46 | 59 | |

### FOG

Warm, moist Gulf air blowing slowly over chilled land or water surfaces brings about the formation of fog. From November through April, fog is encountered occasionally at points throughout the Gulf coast region. It is most frequent in the vicinity of harbor entrances and over land areas extending into the Gulf, such as Cape San Blas. Fog forms with southerly winds and dissipates during northerly winds. The heaviest occurrence of fog is usually in the early morning hours. It is generally at a maximum in winter with little heavy fog in summer.

Generally, coastal fogs last three or four hours although particularly dense sea fogs may persist for several days. Visibility offshore Louisiana is reduced to less than 5 km on a monthly average of four percent of the time. Poorest visibility conditions occur during winter and early spring when visibility is reduced to less than 5 km between 8 and 10 percent of the time (Peake and Muller, 1971).

## Severe Storms

### TROPICAL CYCLONES

The largest and most destructive storms affecting the Gulf of Mexico and adjacent coastal zone are tropical cyclones. These have their origin over the warm tropical waters of the central Atlantic Ocean, Caribbean Sea or southeastern Gulf of Mexico. They occur most frequently between June and late October (Brower, et al., 1972) and there is a relatively high probability that tropical cyclones will cause damage in the Gulf of Mexico each year. Statistics for hurricanes and tropical cyclones are often lumped together since it is often difficult, especially in the older records, to determine the storm intensity while at sea. The probability of a tropical cyclone or hurricane influencing the north-central Gulf coast during any given year is one in six. Hurricanes vary considerably in intensity track patterns and behavior upon crossing land. McGowen, et al. (1970), explains that the storm approach is marked by rising tides and increased wind velocities; generally the longer a storm lingers in the Gulf, the larger the bulge of water it pushes ashore as it approaches land. These storm tides are commonly higher in the bays than on Gulf sea beaches, although flooding and pounding waves effect both areas.

There is no preferred approaching route of hurricane tracks although early season cyclones approach generally from the southeast while later ones are more out of the south. In spite of the fact that most hurricanes form in tropical ocean areas, a few are generated in the Gulf of Mexico. During the period 1901-1971, seven hurricanes and seven tropical storms formed in the Gulf north of 25° N and east of 85° W. See General Gulf, Visual No. 2 for 1954-1975 hurricane tracks.

Damage from hurricanes results from high winds and, particularly in the coastal areas, the storm surge or tide which is an abnormally high rise in the water level. Maximum surge height at any location is dependent on many factors including bottom topography, coastline configuration and storm intensity. The storm surge associated with ‘‘Betsy’’ in 1965 reached nearly 1.6 m at Bayou Lafourche (U.S. Department of the Army, 1973); Hurricane Carla, in 1961, produced 7 m tides in Lavaca Bay, Texas. Hurricane ‘‘Camille’’ was the most severe hurricane in recent Gulf history, with top winds estimated at 324 km/hr, and barometric pressure in her calm eye as low as 68 cm of mercury.

The flood tides and high waves carry shells and sediment from deeper offshore areas onto seaward beaches, spreading a veneer of deposits over the broad, flat hurricane beaches. In the marsh areas extensive and prolonged inundation and ponding occurs, resulting in damage or loss to habitat and man-made structures. The storm surge flood may also produce breaches or channels in natural barrier islands or in levees.

In addition to the tropical cyclones, extratropical cyclones that may vary greatly in intensity occur in this area primarily during the winter months. These storms have attained wind speeds as great as 55 to 93 km/hr. They originate in middle and high latitudes forming on the fronts that separate different air masses. The Gulf of Mexico is an area of cyclone development during the cooler months due to the contrast in temperatures of the warm air over Gulf waters and the cold continental air over the United States. These storms rapidly dissipate, or move on, after going out over the Gulf of Mexico.

### POLAR OUTBREAKS

A phenomenon known as ''norther'' is quite common in the area in question during the winter months. A norther occurs when cold, polar air moves southward from the cold interior of the North American continent out over the warm waters of the Gulf. This unstable cold air mass, when heated from below, develops strong gusty northerly winds with considerable cloudiness and showers. During a typical winter as many as 30 such cold outbreaks reach the Gulf Coast. The majority of these cold outbreaks, spilling out over the Gulf, produce winds in the 28-37 km/hr range but approximately one-third of these cold outbreaks have winds over 62 km/hr with approximately half of these being vigorous enough to reach 89 km/hr, (U.S. Dept. of Comm., 1967).

## Physical Oceanography

### Circulation

#### LOOP CURRENT

Circulation in the Gulf of Mexico is dominated by the ''Loop Current'' which is strongest during the late summer through winter. Circulation of warm Caribbean waters can extend as far north as the Mississippi Delta (Fig. C-1). Eddy currents off the major loop probably account for nothern growths of coral such as the Florida Middle Grounds offshore Florida and the Flower Garden reefs offshore Texas. Current trajectories in the Gulf have been mapped for many years by the Naval Oceanographic Office (1955). The Surface Current Wind Roses shown in Western, Central, and Eastern Gulf, Visual No. 6, are from a compilation of Naval Oceanographic Office Data. Additional Loop Current data are contained in: USDI (1975c), Eleuterius (1974) and Sweet (1974). These studies show that water movements in the Gulf of Mexico are controlled by a variety of interacting forces including fresh water inflow from land, currents set up by winds, currents and water transport induced by surface gravity waves, tidal currents, currents associated with internal waves and movement of water masses due to density differences.

The general circulation pattern for the eastern Gulf consists of a clock-wise Loop Current flowing in through the Yucatan Strait and out through the Florida Strait (Fig. C-2). This is essentially an extension of the Yucatan Current which flows into the Gulf, circles to the right and flows out through the Florida Strait to join the Gulf Stream Current. The western half of the Gulf has no strong, semi-permanent currents but is characterized by a well-defined pattern of winter flow and a highly variable summer pattern (Nowlin, 1971). There is a general westward sweep of currents along the northern shelf west of the Mississippi Delta. Another mass of water moves northward along the Mexican coast to a zone of convergence off Texas. All the currents in the western Gulf seem to flow toward this general zone.

#### SURFACE CIRCULATION

Figure C-3 depicts surface circulation trends along the Louisiana coast, emphasizing the general westward movement of currents. The nearshore regime in this area is influenced by several factors, among them winds, tides, offshore current flow and fresh water discharge from coastal rivers. In most areas significant winds are the major control of surface currents.

Currents around the Mississippi Delta are strongly influenced by the fresh water outflow from the river. At Head-of-Passes the Mississippi River branches into three major channels: Pass-A-Loutre, transporting 31.5% of the total river discharge; South Pass, 17% and Southwest Pass, 31.5% (Dept. of Army, 1976). Fresh water discharge rates vary seasonally with highest values occurring during the spring and lowest in the fall. Outflow from the Mississippi Delta maintains its general integrity as it passes over the more dense, saline underlayer. Scruton (1956) observed a fresh water plume extending 20 m off Pass-A-Loutre. This has been confirmed by Eleuterius (1974) whose data indicates that at times this plume extends some forty miles eastward. Fresh water plumes to the south and west are less well known, however, they undoubtedly exert considerable influence.

After sweeping westward along the Louisiana continental shelf prevailing surface currents turn southwestward, roughly paralleling the Texas coast. Another surface current system moves northward along the Mexican coast to a zone of convergency off Texas. The actual area in which the north and south moving currents converge changes throughout the year in response to atmospheric conditions. In winter the area is to the south of the United States-Mexican border. The area shifts gradually northward during the spring and summer months. Current velocities range in speed from about 0.7 to 2.8 km/hr.

#### BOTTOM CIRCULATION

Little is known about bottom circulation in the Gulf of Mexico. Bottom current measurements although feasible are so rare that circulation patterns can not be described. Reports from divers indicate that bottom currents can be strong enough to make diving hazardous and mobility in some areas difficult. Several recent monitoring efforts in the Gulf of Mexico have shown there may be no apparent relationship of bottom currents to surface currents.

### Sea Surface Temperatures

According to Leipper (1959a), the main feature of the average winter sea surface temperature for the Gulf of Mexico is a gradual drop from ap-

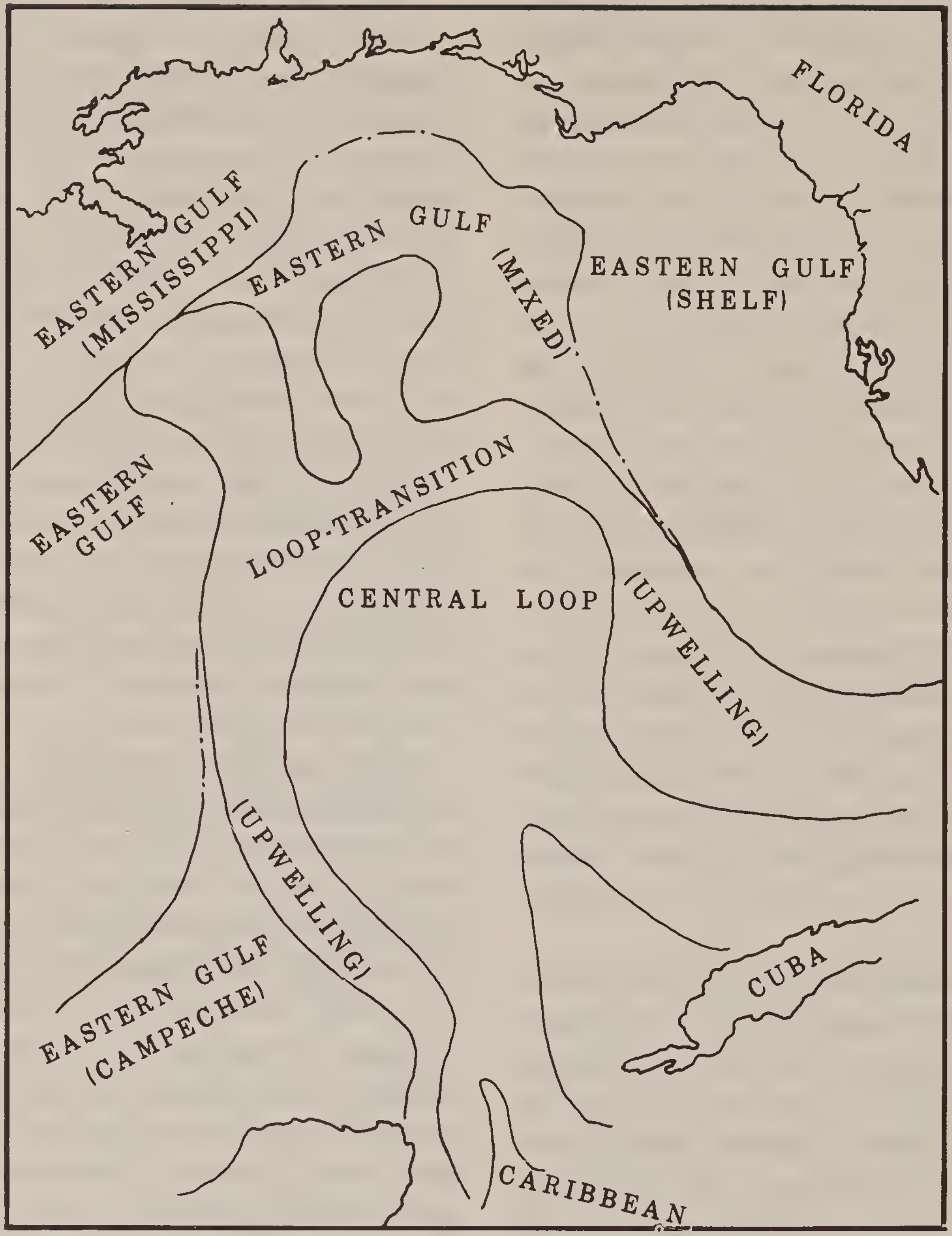


Figure C-1 Water Masses in the Eastern Gulf of Mexico During May 1970 (From Austin, 1971).

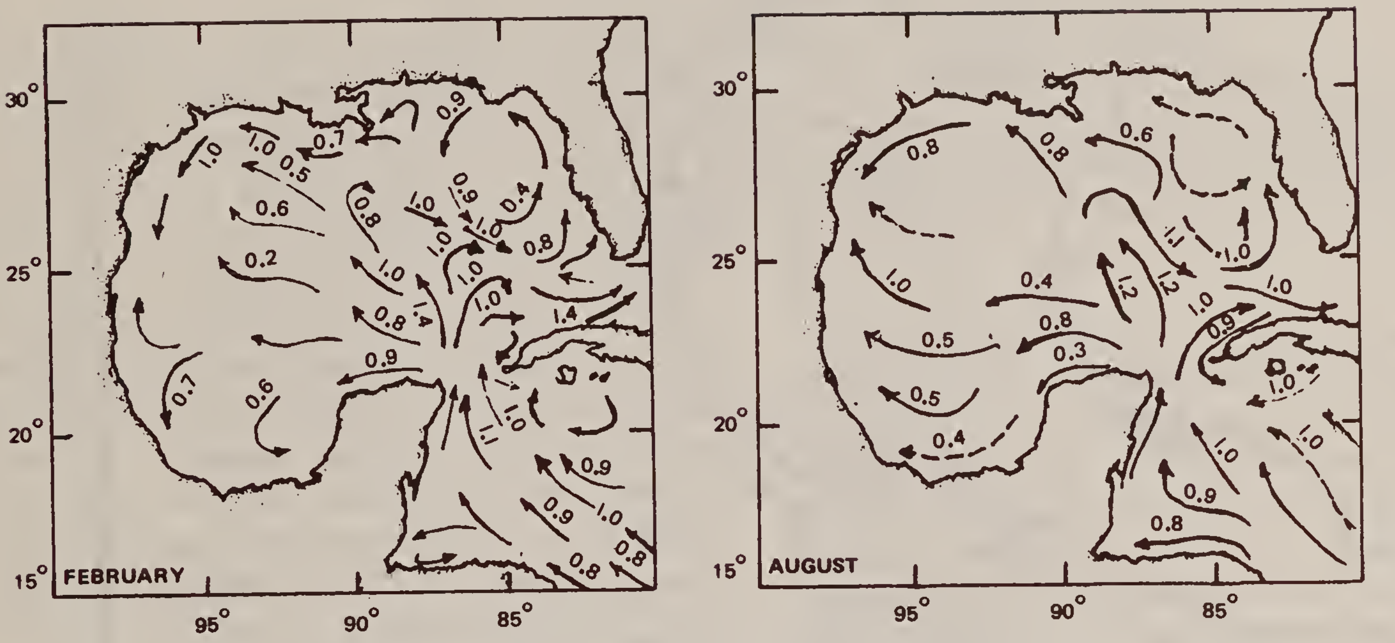


Figure C-2 Estimated Average Speed (Knots) of Surface Currents in the Gulf of Mexico from U. S. Naval Oceanographic Office Pilot Charts for February and August (After Nowlin, 1971)

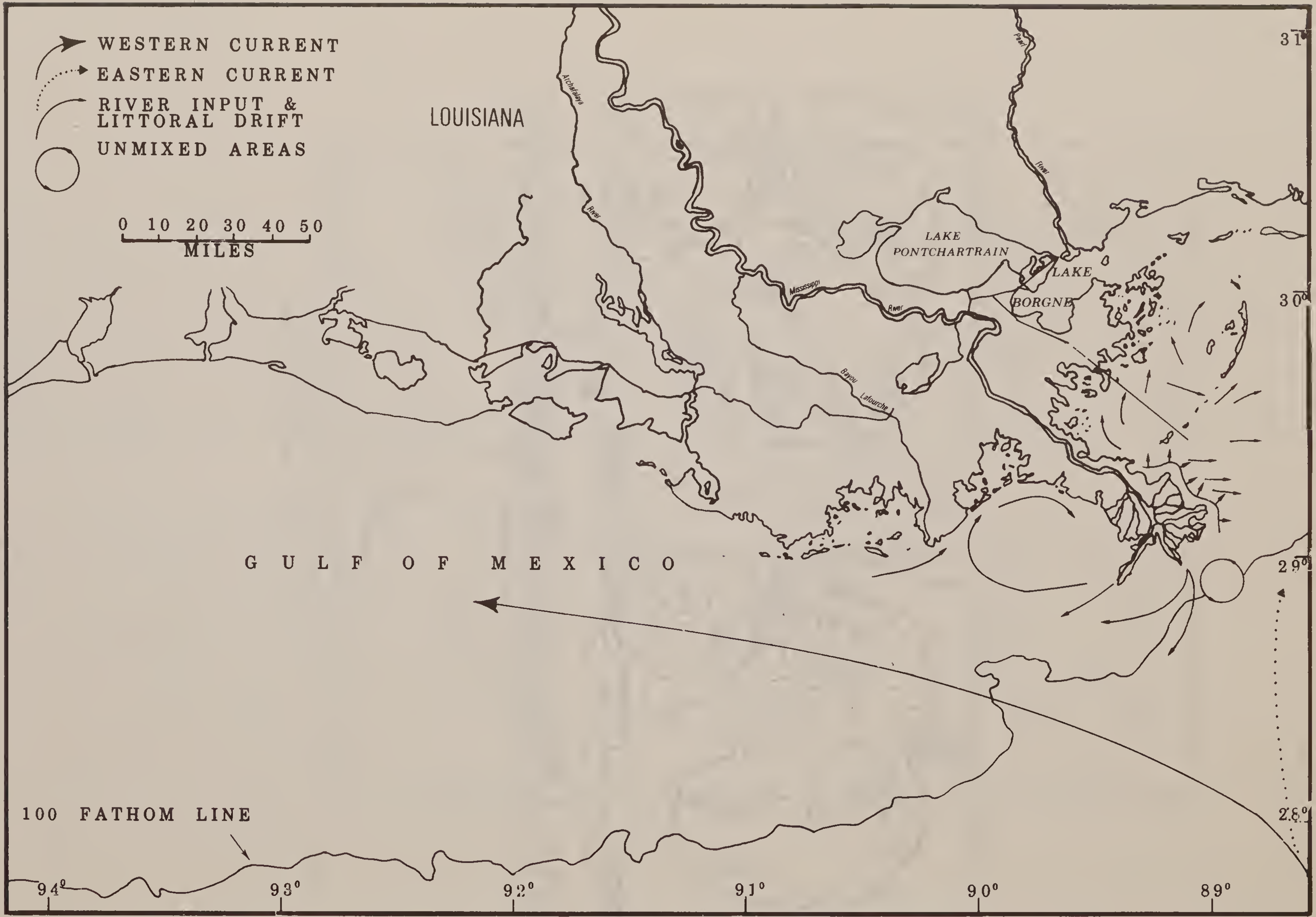


Figure C-3 Generalized surface circulation along the Louisiana continental shelf (from Stone, 1972).

proximately 24° C in the south to 18° C in the north in all parts of the Gulf. In the summertime, average temperatures are very nearly uniform at 29° C throughout the Gulf. Years of investigations have shown that considerable deviation from these average isotherms may occur at certain times. In shallow coastal waters and in estuarine and marsh areas, water temperatures approximate air temperatures, but without reaching the extremes exhibited by air temperatures on the short term.

**Tides**

The tides of the Gulf of Mexico are weakly developed and usually their observed range does not exceed 0.7 meters (Durham and Reid, 1967). Semidiurnal (twice daily) tides are small, and therefore, overall tides in the Gulf are considered diurnal (daily) in character. In 1897, R. A. Harris (Grace, 1932) suggested that the diurnal tides of the Atlantic Ocean influences the tides in the Gulf through the Yucatan Channel. Later in 1900, he expressed the opinion that a single oscillating system with a nodal line extending from western Haiti to Nicaragua is formed by the Gulf of Mexico and the Caribbean Sea. This would cause the tides of the Gulf to be simultaneous. In 1908, Enros (Grace, 1932) arrived at a similar conclusion considering the Gulf and the Caribbean Sea to be a single oscillating body with a period of nearly 24 hours. Tidal regimes have been shown for the Gulf of Mexico as displayed by Eleuterius (1974) in Figure C-4.

In 1908, C. Wegmann (Defaunt, 1961), considered the resonance effect of the diurnal components of the Gulf and found the period of free oscillation for an east-west oscillation to be 24.8 hours. According to Grace (1932) the diurnal tide enters through the Florida Straits, progresses counterclockwise around the basin, is reflected by the northwestern and southern coasts and egresses through the Yucatan Channel.

When the moon is near its maximum declination, the tide is diurnal and has the greatest range. When the moon is over the equator, the tide has the least range and there may be several days having two highs and two lows. Although tides in the Gulf have a small range they do have important roles in modifying currents and accelerating the movement of water through narrow passages.

Spring tides are slightly higher, but since the range is so small, meteorological effects can completely mask tidal fluctuations (U.S. Dept. of Commerce, 1967). For instance, an onshore wind can pile-up water against the coast to a height of 1.2 meters above mean sea level. Tides are diurnal (one high and one low per day), with maximum ranges recurring about every two weeks (Stone, 1972). Highest mean water level occurs during the period December through March.

Tidal currents do have some small effect on flushing rates in enclosed bays, but because tidal ranges are small, currents resulting from tides are also small.

**Sea, Wind, Waves and Swell**

The coastaline of the region of the proposed sale is characterized as a low energy area in terms of wave power (Stone, 1972). The annual average wave height is 0.9 m (Brower, et al., 1972), with 75% of all waves being smaller in height than 1.5 m.

Direction and height of waves at an offshore station closely correlates with wind direction and intensity. On an annual basis waves come out of the northeast, east, southeast and south 70.9% of the time (Stone, 1972). July and September data reflect the strong influence of the southerly winds resulting from circulation around the Bermuda High. The shift to more northerly and northeasterly wave origin accompanies the change in wind direction in winter when it is dominated by continental air masses and "northers". From May to August 80 to 90% were 1.5 to 2.4 m in height, and less than one percent exceeded 3.7 m in height. Waves from the northeast and southwest tend to have greater heights than those from other directions.

Stone (1972) reported that wave power along the coast is less during spring and summer and greater during autumn and winter by a factor of 2 or 3. He further states that the Mississippi and Atchafalaya (off Vermilion) deltas are advancing and the Barataria and Terrebonne coastlines are retreating. In the latter case, the rate of retreat is 7 to 15 m/yr, in the former case it is 3 to 7 m/yr.

The wind velocity, the distance over which the wind blows (fetch), and the length of time that the wind blows (duration) all have a direct effect on wave growth. In general, any increase in one of these factors will result in larger waves. Sea is a term applied where waves are actively being generated. Swell refers to long period uniform waves some distance from the generating influence.

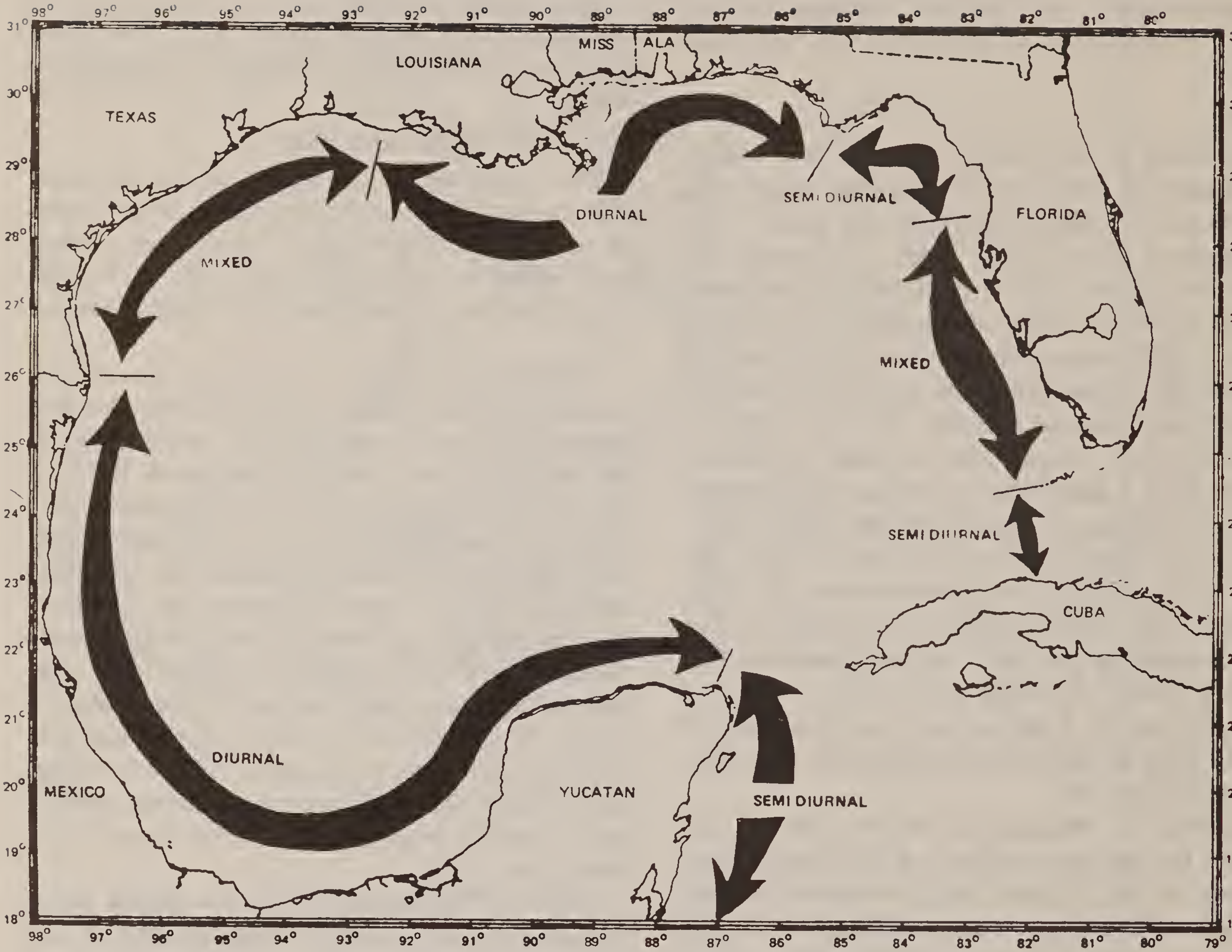


**FIGURE C-4 GULF OF MEXICO TIDAL REGIMES.** From Eleuterius, C. K. 1974. Mississippi Superport Study, Environmental Assessment.

The average height of waves in the Gulf average from 0.9 to 1.2 meters. Higher wave heights occur during the period of November through March when strong northerly winds prevail.

Prevailing winds during spring, summer and early fall are from the southeast and wave heights are generally less during this period. Waves associated with storms range considerably higher. During hurricane ''Camille'' in 1969, for example, waves 21 m high were reported offshore, with winds exceeding 322 km/hr.

Due to the coriolis effect sea breezes rotate clockwise in the northern hemisphere during a 24 hour period. Usually the sea breeze will start around 1000 hours, reach a maximum at 1400 hours and afterwards be replaced by the nocturnal land breezes. To answer questions on amplitude phase and frequency of responding waves, currents and beach erosion and deposition, a fully instrumented project was undertaken on Santa Rosa Island, Florida, by Sonu, et al. (1973). Their results demonstrated that sea breeze significantly affected the dynamic processes operating on the coast in the following summary:

(1) Meteorological parameters such as aerodynamic roughness, shear stress and atmospheric stability exhibited definite coupling with the wind speed. A new relationship between the friction velocity and the wind speed at 10 meters was found; this new relationship contrasts with conventional deepwater expressions. The aerodynamic roughness depended not only on waves, as was expected, but also on atmospheric stability mainly associated with land breeze.

(2) The sea breeze produced a high-frequency peak in the nearshore wave spectrum that dominated the background swell in the afternoon and evening. The response of the wind waves involved amplitude, frequency and direction, whereas that of the swell was primarily limited to amplitude.

(3) Nearshore currents responded with a lag of 3-5 hours to the onset of the sea breeze cycle with current amplitudes of up to 25 cm/sec. As a consequence of the proximity of the coast and the surface slope associated with wind setup, these currents flowed essentially parallel to the shoreline and had only minor onshore-offshore components.

(4) Wave-induced currents around and inside the inner bar underwent systematic diurnal variations in response to offshore wave breaking and incident angles of the diurnal wave field, changing from closed circulations (early afternoon), to meandering currents (late afternoon), to weakly curved parallel currents (night and early morning).

(5) The beach system acted as a low-pass filter to input waves, so that both swash and groundwater fluctuations underwent high-frequency attenuation. The cutoff frequency varied as a function of the combined effects of the tide and diurnal wave field.

(6) Topographic response exhibited dependence on the scale of topography and excitation frequency. Whereas small-scale features such as ripples, megaripples, and beach cusps changed within a hourly or shorter time scale, large features such as crescentic bars and rhythmic shorelines on the order of 120 meters in wavelength remained unresponsive for over three weeks.

## Chemical Oceanography

### Nutrients

In the marine ecosystem phytoplankton constitute the primary producers and as such are dependent on an adequate supply of three essential nutrients: nitrogen, phosphorous. The primary sources of supply of these nutrients are upwelling of deep waters, advection and discharge from land sources (rivers and industrial and domestic sewerage). The primary process depleting the concentration of nutrients in the surface is rapid uptake by phytoplankton and consequent removal of the phytoplankton by predation or by sinking. As a result, only low concentrations of nutrients are normally found in surface waters except in local source areas.

Major source areas of turbidities are the rivers and bay outlets into the Gulf of Mexico, principally the Mississippi and Rio Grande rivers. Organic content of the waters are high bordering south Louisiana and Texas. Fanning (1974) rejects upwelling as the cause of the bottom enrichment and favors this enrichment from release of the nutrients from bottom sediments through diffusion or seepage. Manheim (1974) points out that the intermediate and surface nutrient values could be caused by uptake by benthic algae.

### Salinity

The salinity patterns of the Gulf of Mexico (Fig. D-1) are principally determined by: inflow of ocean waters through the Yucatan Strait, precipitation and inflow of fresh water from land sources, evaporation, circulation and mixing and outflow through the Straits of Florida. In the northern Gulf runoff from the Mississippi, Atchafalaya and from smaller rivers to the east and west gives rise to a band of low-salinity water (Nolan, 1972).

In the upper 50 m, water in the central Gulf of Mexico typically has a salinity of very near 36.0 parts per thousand (Leipper, 1954b). The distribution of surface salinities in the winter is generally lower. A similar distribution pattern, but with generally higher salinities because of high evaporation rates, is found for summer conditions. In the eastern Gulf these distributions are modified by the seasonally dependent Loop Current (Sackett, 1972).

### Trace Metals

The trace metals that usually occur in the marine environment include cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, iron, uranium and zinc. These occur in concentrations normally less than one part per million (1 ppm.). These metals can enter the marine environment through weathering of rocks or by pollution discharge of human development.

Analysis of sediments to determine concentrations of heavy metals were made by the U.S. Geological Survey for the South Texas OCS (Berryhill, 1975). The following conclusions have been drawn from this study.

As a regional pattern, the trace metals content of sediments in estuaries adjacent to the continental shelf are relatively higher than in the sediments of the OCS.

Compared to the average trace metals content for the south Texas OCS as a whole, only cadmium and manganese are significantly high. For several trace metals, including cadmium, the highest concentrations are in the area of suspected gas seeps along the outer edge of the shelf in the northeastern part of the OCS.

The suspected gas seeps appear to be emanating upward along fault planes and may be depositing trace metals in the sea floor sediments, thus explaining the higher concentrations of some trace metals there.

In the south Texas OCS, the average levels for all trace metals determined are lower than the average levels for the segment of the northwestern Gulf shelf immediately to the north. For the overall northern Gulf of Mexico continental shelf, the average levels within the south Texas OCS are comparable.

Knowledge of trace metals concentrations in sediments of other continental shelves of the United States is too scant to permit comparison with the shelf off south Texas

A most intensive study of trace metals in the Gulf was completed by Corcoran (1972) for six trace metals: Cd, Pb, Cu, Cr, Zn and Mg. Except for copper, the concentration of the five other metals was ten times the concentration typically observed in open ocean waters. Also, manganese was higher than concentrations reported by Rona, et al. (1962). This seems to indicate enrichment of trace metals by the Mississippi River and from Escambia and Perdido bays.

*Gulf of Mexico · Physical Aspects*

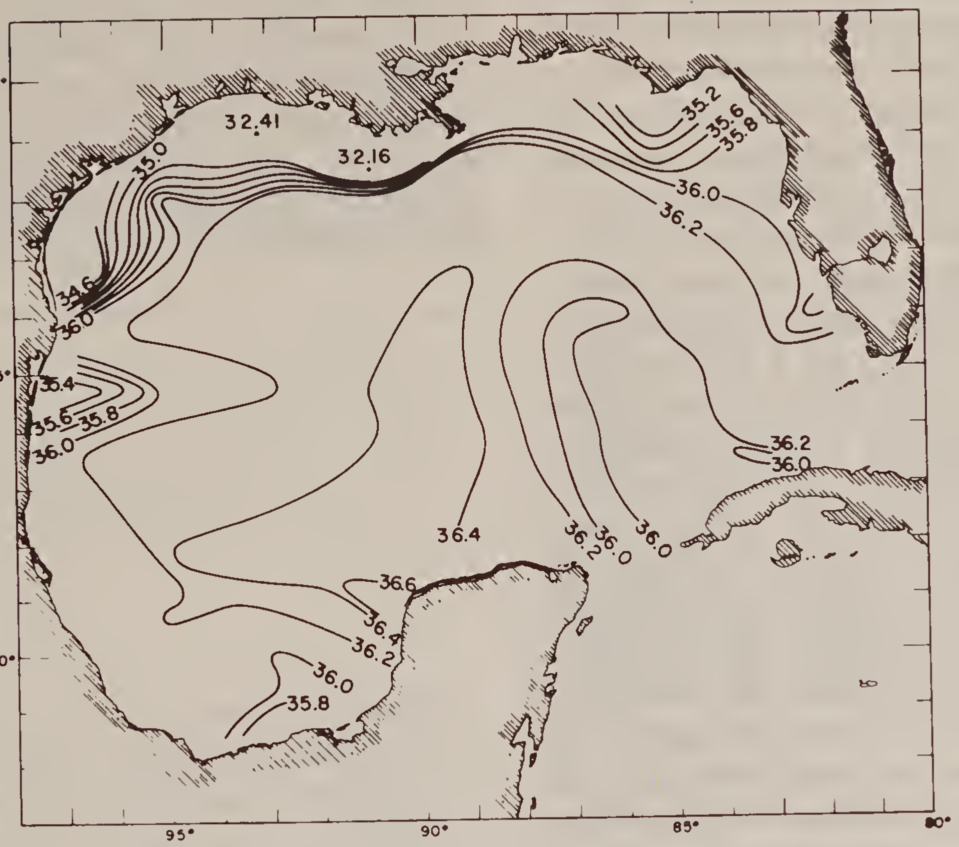
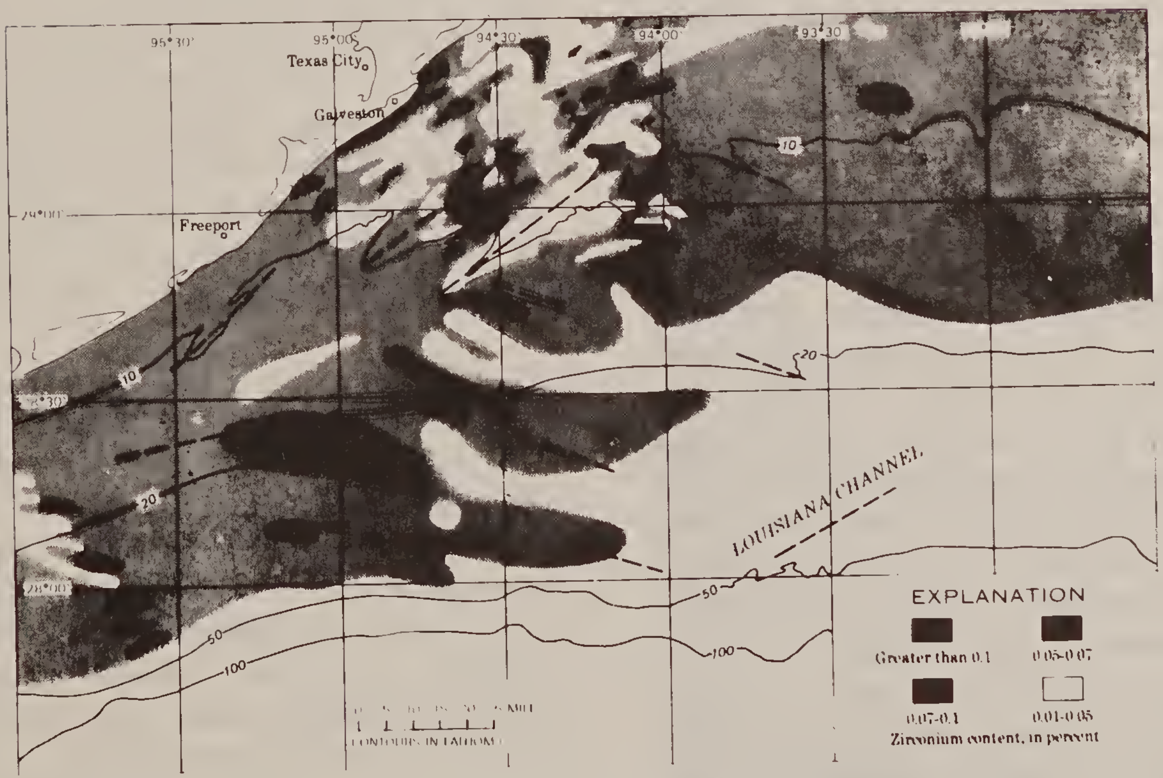


***Figure* D-1** *Surface salinities (parts per mil),* Hidalgo *62-H-3.*



Figure**D-2** Distribution of zirconium in the central part of the northwest Gulf of Mexico shelf. Dashed lines approximate the axes of the topographic ridges

When adequately sampled it appears that trace metal data can complement or reinforce circulation information and can indicate dynamic characteristics. Evidence of this is discussed in A Summary of Knowledge of the Eastern Gulf of Mexico (Jones et al., 1973) as follows:

An examination of the distribution of trace metals in the ESCAROSA (Escambia-Santa Rosa counties) area indicates that water movements are complex. There seems to be a general movement of surface waters from east to west. Salinity, silicate and manganese data indicate a surface flow of water out of the bays, yet the trace metal data show an offshore enrichment with no apparent surface connection. This would indicate that the trace metals are carried below the surface upon their entrance into the Gulf, only to rise again a few miles away in small divergent areas, or they are entrapped within the bays and their offshore enrichment comes from the Mobile Bay and Mississippi River sources, or the surface waters are enriched by wind-carried aerosols. Possibly all three processes contribute. Sediment studies seem to indicate bay entrapment, but it is also well known that trace metals are released from sedimentary particles upon contact with saline water, and it is also well known that trace metals (especially lead) are constituents of the aerosols.

Slowey and Hood (1969) have reported high trace metal content at intermediate depths in Gulf water. They found this metal content at intermediate depths to decrease as the water moved through the Gulf of Mexico and concluded the metal origin to be from outside the Gulf, either from residual subantarctic intermediate water, or from continual rain of decaying organisms with their resultant release of metals during the northward transit of the water. The outside origin of high metal content of intermediate water seems reasonable and feasible. However, the conclusion is based on the resemblance of copper, manganese and zinc distributions in the Gulf to these found at one station taken from Cuba.

A map of trace metals for the Gulf of Mexico sediments has been proposed by Holmes (1973) from a semiquantitative analysis of sediment samples taken mainly from NMFS Geronimo cruises. Holmes (1971) has prepared a detail map of zirconium distribution in the northwestern Gulf from Galveston to beyond the Flower Garden Banks, Figure D-2. His analyses indicate that the highest trace-element concentrations are in regions of the shelf that are actively receiving sediments. The zirconium concentrations are an exception because they are deposited in areas of slow deposition along the elongate bathymetric features in offshore Texas. This correlation of zirconium concentration to the elongated features suggests that the topographic features are ancient shorelines that have been submerged during the past Pleistocene rise in sea level.

## Biological Oceanography

Considerable data is available concerning the biology of the Gulf of Mexico. Previous environmental statements prepared by the Bureau of Land Management have treated this subject in detail. Reference to the following environmental statements are suggested for a more detailed discussion on the biology of the offshore environment for this proposed sale area.

Louisiana—Final Environmental Statement, Vol. 1, OCS Sale No. 36, pp. 199-226.
Texas—Final Environmental Statement Vol. 1, OCS Sale No. 38, pp. 176-196.
Gulf of Mexico—Final Environmental Statement—Programmatic, pp. 328-351.
Gulf of Mexico—Final Environmental Statement—Vol. 1, OCS Sale No. 41.

### Plankton

#### ZOOPLANKTON

According to Bogorov, et al. (1968) the distribution of zooplankton for the Gulf of Mexico is 51-200 mg/cu. m. In addition, Khromov (1965) studied the quantitative distribution of zooplankton biomass in the northwest Caribbean Sea and most of the Gulf of Mexico, and indicated a zone of low zooplankton density (0.5g/cu.m) east of Galveston; southwest of Galveston the nearshore density exceeded 0.5g/cu.m in the shallow coastal waters with lower densities seaward.

The most important grazers are the copepod crustaceans, which are the most abundant zooplanktonic group in any given plankton sample (Raymont, 1963). Where phytoplankton populations become abundant, copepod populations will also flourish.

Common copepod species found in neritic Gulf waters include the calanoid copepods *Euchaeta marina*, *Neocalanus gracilis*, *Scolecithrix dana*, *Candacea pachydactyla*, *Unidinula vulgaris*, *Eucalanus attenuata* and *Acartia tonsa*, as well as the cyclopis copepods *Copilia mirabilis* and *Corycaeus* spp. Euchaeta and Corycaeus differ from the rest in being carnivorous. *Acartia tonsa* is a dominant nearshore form in bays and estuaries of Texas and Louisiana, and is found less commonly offshore (Gillespie, 1971).

Euphausiid crustaceans are also prominent members of the zooplankton assemblage. Major species found in the Gulf are *Euphausia americana*, *E. mutica*, *E. brevis* and *Stylocheiron carinatum*. Feeding habits of euphausiids have variously been described as herbivorous, carnivorous and detritivorous.

Possibly the most significant carnivores in the zooplankton are the chaetognaths (arrow worms). Copepods dominate their diet but this may be an artifact based on relatively high copepod abundance (Raymont, 1963). They also feed on fish and barnacle larvae. The genus *Sagitta* is common worldwide; Gulf species include *S. setosa*, *Pterosagitta sp.*, *Krohnitta sp.* and *Eukrohina sp.*

Other common carnivores in the zooplankton include the ctenophores (*Pleurobrachia* and *Beroe*), medusae of various species, ostracods, cladocerans (*Podon* and *Evadne*), mysid and amphipod crustaceans, heteropods, (*Atlanta leseuri*), pterpods, salps and pyrosomes. Another significant group of carnivores are the various larval and immature forms, both holoplanktonic and meroplanktonic organisms. These include most of the crustaceans mentioned, the tunicates, echinoderms, cephalopods, ectoprocts, sponges, annelid and nemertean worms. Fisheries larvae are important carnivores, and the survival of larvae of commercial fish has an obvious economic impact.

James, et al. (1972) extrapolated from the taxonomic studies of the eastern Gulf and the few Texas zooplankton collections which have been examined, and concluded that Texas shelf waters are quite rich in the same zooplankton species found elsewhere in the Gulf, with representatives from many diverse biotic groups.

#### PHYTOPLANKTON

El-Sayed (1972) used measurements of *chlorophyll a* (a bluish black pigment found in phytoplankton) to calculate estimates of the phytoplankton standing crop (total number or weight of living organisms momentarily present in an environmental unit, Pennak, 1964) for the Gulf of Mexico. Surface *chlorophyll a* showed higher concentrations (high standing crop) during the winter than at any other season; these were followed by a decrease in the standing crop of phytoplankton during spring, and a gradual increase in summer and fall. In terms of *chlorophyll a* (sea-surface values and data integrated for the euphotic zone), the Gulf of Mexico is no different from other tropical or sub-tropical bodies.

The levels of gross primary production (total quantity of green plant protoplasm produced per unit time in a specific habitat) in different geographic localities in the Gulf of Mexico resemble the distribution of the phytoplankton standing crop. As with *chlorophyll a*, the surface and integrated (with the euphotic zone) primary productivity values in the inshore water (0.55mg C/cu.m/hr and 7.04mg C/sq.m/hr respectively) were higher than those values for offshore waters (0.21mg C/cu.m/hr and 5.45mg C/sq.m/hr). The average primary productivity of the Gulf was 0.15g C/sq.m/day (El-Sayed, 1972).

The open Gulf phytoplankton assemblage includes the diatom genera *Gossleriella*, *Ethmodiscus* and *Planktoniella*, and the dinoflagellate genera *Teiposolenia*, *Heterodinium*, *Amphisolenia*, *Murrayella*, *Histioneis*, *Ptychodiscus*, *Cladopyxis*, *Kofoidinium*, certain *Ceratium* spp. and *Pyrocystis*, according to Steidinger (1973). While the dinoflagellates are more diverse in this area, they do not necessarily dominate the standing crop.

Graphic representation of the Gulf of Mexico phytoplankton production (mg C/sq.m/d) benthic algae and seagrasses may be found on general Gulf, Visual No.3.

### Benthos

The benthic communities for the OCS can be broadly described as shallow, intermediate and deep shelf assemblages, and slope assemblages. Within these broad areas, more specific assemblages can be described for shrimp grounds, oyster grounds, sand bottoms, silt and mud bottoms, rocky bottoms and hard banks. For location of these bottom types see the following visual graphics: Bottom sediments—western and central Gulf, Visual No. 3; undersea features—western and central Gulf, Visual No. 4; Coastal zone and offshore fisheries—western and central Gulf, Visual No. 5; Migration of Gulf of Mexico penaeid shrimp and main fishing grounds—general Gulf, Visual No. 5.

The organisms are generally distinct for each of the three neritic zones (supratidal or supralittoral; intertidal or littoral, and subtidal or sublittoral), but specific species may be found in more than one zone. Zonation is characterized more by dominant species than by distinct assemblages of numerous species.

The main benthic floral groups are the seagrasses and the benthic algae, (General Gulf Visual No. 3). The seagrasses have been discussed previously, and their outer limits define the inner limit of the offshore environment for this report. The benthic algae predominantly inhabit rocky coastlines and hard bottom. The capacity of such habitats in the Gulf of Mexico area allows the seagrasses to dominate the benthic algae. Representatives of the four major phyla of algae (cyanophyta, blue-green; Rhodophyta, red; Phaeophyta, brown; Chlorophyta, green) may be found in suitable locations, but in offshore waters, red and brown algae predominate (Odum, 1971). In exceptionally clear waters, benthic algae are known to grow in at least 183 meters of water, especially coralline red algae, and apparently green, brown, and non-coralline red algae as well (Humm, 1973). Locally, in depths of 18-91 meters there may be extensive bottom cover of algal nodules, fist-sized and larger spheroidal aggregations of coralline algae and carbonate debris (Logan, 1969).

The epifaunal representatives offshore Louisiana and Texas include almost all animal phyla. They range from the sessile organisms like sponges and anemones to the slower moving forms such as shrimp and crabs to the highly motile demersal fish. Demersal fish include the commercially important species such as: flounders, red snapper, croakers, groupers, etc...

The most important commercial epifaunal species for the Gulf of Mexico are the brown shrimp, (*Penaeus aztecus*), the white shrimp (*Penaeus setiferus*), sea bob (*Xiphopeneus kroyeri*) and the royal red shrimp (*Hymenopenaeus robustus*). Royal red shrimp are found in deep waters from 175 to 300 fathoms.

#### TEXAS AND LOUISIANA SHELF

Parker (1960) conducted a detailed study of the benthic communities off the Texas and Louisiana coast. He divided the offshore communities into the following habitats: surf zone or sandy beaches; inner shelf, 4 to 23 meters, intermediate shelf, 24 to 65 meters; outer shelf, 69 to 120 meters; the upper continental slope, 125 to 1200 meters and the calcareous bank community and speciated organisms for each assemblage for characterization of each community.

In summary he found that variations occur within the major associations according to sediment type. Assemblage living within silty clays in the intermediate shelf community are completely different in composition from those on sandbottom at the same depth. Certain species do bridge the two sediment types to create larger associations. Studies of the continental shelf in other parts of the world and in all oceans proved the same basic assemblages listed for Louisiana and Texas occupy similar depths in the same latitudes (Parker, 1960).

**Nekton**

Nekton for the offshore waters are represented by five major taxonomic categories—marine mammals and reptiles, the fishes, the cephalopod molluscs (octopuses and squid) and certain crustaceans (shrimp and swimming crabs), (General Gulf, Visual Nos. 4 and 5). Individuals of this group commonly but not always, range over broad areas, thus participating in several biotic communities. However, most nekton is limited in geographic and vertical ranges by the same environmental conditions as less mobile organisms, i.e., temperature, salinity, available food, and types of bottom.

The nekton component of the environment can be divided into strictly open water nekton, and nekton which spend some portion of their lives in nearshore, estuarine, or marsh waters. Many of the finfish of commercial and sportfishing importance are strictly offshore residents, such as the red snapper, various groupers, sailfish, and marlin. Of particular importance from commercial and sport fishing standpoints are the semi-catadromous species which spawn in open water, move inshore to bays and estuaries for their juvenile life stage and return to deeper waters as adults.

The majority of biologists who have worked in the northern Gulf of Mexico have called attention to the presence of mainly warm-temperate or subtropic assemblages rather than tropical or Caribbean biota. The fauna is comparatively rich and includes many species that are found nowhere else, yet less is known about it than that of any other coastal section of the United States.

Knowledge on shelf and offshore fisheries for the western and central Gulf has been mainly limited to check lists, identification keys, and distributional studies. James, et al. (1972) stated that very little is known about the ecological relations of most fish species of the shelf, especially those which live beyond the inner shelf. The inner shelf area is defined by Parker (1960) as that region between 4 to 23 meters water depth, intermediate 24-65 m and outer 66 to 120 m. Data presented by Hildebrand (1954) and Moore, et al. (1970) on fish faunas of the inner and intermediate shelf showed catches on the inner shelf to be less abundant and less diverse than those on the intermediate shelf. Hildebrand (1954) recorded only 80 fish species from the inner shelf whereas 122 species are recorded for the intermediate zone.

Members of the nektic assemblage ranging over broad areas of the pelagic environment include squid and the schooling fishes, such as the amberjack, crevalle jack, horse-eye Jack, bluefish, king mackerel, various anchovies and herrings, and menhaden. Several types of pelagic fishes do not travel in schools, but rather roam alone or in small groups. These types include the cartilaginous fish, the sharks, and the bony fish, such as Atlantic sailfish, and blue marlin.

Certain oceanic fish visit the shelf waters during the summer months. These include the mackerels, bonito, amberjack, blue runner, dolphin and a number of billfishes and other species of sport and commercial interest. These wide-ranging, fast-swimming predatory fishes are often caught within sight of shore, especially around the mouth of passes where they feed on anchovies, silversides, squid, shrimp, and bottom fishes.

Data by James, et al. (1972) from fish collections on the continental shelf of Texas in 1971 suggested a greater species diversity for the inner shelf and greater abundance on the outer shelf, with the intermediate shelf being intermediate in fish diversity and abundance, (Table E-1). Catches on the inner shelf are seasonally quite variable and tend to be dominated by species which utilize the estuarine habitat in part of their life histories.

The fish fauna of the northeastern Gulf is richer due mainly to the presence of a number of eurythermic tropical species. It has been suggested (Briggs, 1958) that this contrast in species diversity may be caused primarily by presence of different benthic communities.

In the northern Gulf, there is also some indication of speciation with certain warm-temperate genera. For example, one species of Menhaden, *Brevoortia gunteri*, is found in the western Gulf while another, *B. smithi*, exists in the eastern part (Dahlberg, 1970). Similar patterns have been found in the blenniid genus *Chasmodes* (Springer, 1959) and in the flatfish genus *Gymnachirus* (Dawson, 1964). In each of these cases, small areas of geographical overlap have been found but these do not occur for all three genera in the same part of the northern Gulf.

Table E-1 Comparison of Trawl Fish Catches in Relation to Shelf Zone for the Upper and Central Texas Continental Shelf*

| Shelf Zone | Diversity (# of spp.) | Abundance (#/Haul) | Dominant Groups | Dominant Species |
|---|---|---|---|---|
| Inner shelf (4-23 m) | 61 | 161.9 | searobins (26%)<br>flatfishes (21%)<br>drums (20%) | blackfin searobin (*Prionotus rubio*)<br>spotted seatrout (*Cynoscion nebulosus*)<br>Atlantic threadfin (*Polydactylus octonemus*) |
| Intermediate shelf (24-65 m) | 48 | 245.1 | flatfishes (45%)<br>seabasses (20%)<br>searobins (10%) | shoal flounder (*Syacium gunteri*)<br>spotted whiff (*Citharichthys macrops*)<br>blackear seabass (*Serranus atrobranchus*) |
| Outer shelf | 23 | 312.7 | searobins (49%)<br>lizardfishes (31%) | shortwing searobin (*Prionotus stearnsi*)<br>largescale lizardfish (*Sauridia brasiliensis*)<br>blackear seabass (*Serranus atrobranchus*) |

*By R. M. Darnell (Id. by C. Cashman). Most of the collections were made during the period May-July, 1971. Source: James et al., (1972).

Although many studies, Bright & Cashman (1974), Caldwell (1959, 1963), Causey (1969), Hubbs (1963, 1965), Moseley (1966), Smith (in press), Smith, et al., (in press), Walls (1973) have been conducted concerning the fish fauna of offshore banks (hard substrates) of the northern Gulf of Mexico, only one study has been directed towards studying the fish fauna of offshore oil platforms. Sonnier, et al. (1976) made observations, photographs and collections of fishes on the western reefs of the outer Louisiana continental shelf and around oil platforms and verified the presence of an extensive tropical fish fauna. Of 105 species recorded, about 50% were tropical species either unreported or rarely reported from the northwestern Gulf of Mexico. Reefs contained more species than oil platforms, although a number were common to both (Table E-2) and 12 species were found only around platforms (Table E-3). The 67 species of fish found at the deeper reefs were all typical Caribbean—West Indian species. No estimate concerning biomass between the two sides of the Gulf of Mexico has been reported.

Sonnier, et al. (1976) found that platforms generally show a lesser growth of epifauna than the reefs studied, suggesting fewer niches, so their estimate of 49 species occurring on platforms and 93 species on the reefs probably reflects platforms studied were inshore of the deeper reefs and subject to lower temperatures possibly reducing the number of species near platforms.

### Marine Mammals, Birds and Sea Turtles

Several species of marine mammals, birds and sea turtles constitute the wildlife species of the open Gulf. However, due to the difficulty in obtaining data, information is rather scarce in most of the populations.

Woolfenden and Schreiber (1973) summarized data available on the pelagic birds in the Gulf of Mexico. Little is known about the birds of the Gulf of Mexico, however, the records that do exist suggest that the Wilson Petrel is one of the few species of open Gulf waters that occurs regularly in fairly large numbers. The species is virtually never seen within sight of land, and little information is available regarding its food.

Four species of boobies are known to occur in the Gulf of Mexico; however, only one is common in the eastern Gulf, the Gannet. The Gannet breeds in the North Atlantic. The breeding ranges of the three species rare in the eastern Gulf, the Masked Booby *Sula dactylatra*, Red-footed Booby *S. sula* and Brown Booby *S. leucagaster*, though not well known, do not include the eastern Gulf of Mexico.

Jaegers are seabirds that are rarely observed from land. All three species occur in the Gulf of Mexico, but it is difficult to establish the relative numbers of each because all are similar in appearance and infrequently seen. Certainly the Long-tailed Jaeger *Stercorarius longicaudus* is rarest and the Pomarine Jaeger *S. pomarinus* may be less abundant than the Parasitic Jaeger (Williams, 1965).

Sooty Terns and Brown Noddies are true pelagic birds, and the Sooty may be the commonest bird in the Gulf of Mexico. Both these pelagic species disappear from the Tortugas area after their annual breeding (Dinsmore, 1972) and almost never are they seen along the mainland.

Records of Lowery (1960) indicated that oceanic birds in Louisiana waters included shearwaters, jaegers and petrels. It would be reasonable to expect these species to occur throughout the Gulf of Mexico.

During the winter season, hundreds of thousands of waterfowl occupy virtually the entire length of the Gulf coast. Primary species utilizing the open Gulf include, scaups, redheads, canvasbacks, and scoters.

According to data from Rahn and Gelback (1972), four species of sea turtles occur in Texas waters. These include the leatherbacks, hawksbill, Atlantic ridley and green turtles. All but the green turtle are listed as endangered species by the U.S. Fish and Wildlife Service (1975d). Little can be said about their distributions. They may be occasionally observed floating on the surface of the water and are susceptible to being caught by commercial fishermen. However, the few coastal observations and declining occurrences in trawl nets indicate a scarcity of the animals.

The loggerhead is apparently the only species that nests on beaches in the Gulf of Mexico. Reports indicate the species may nest on the Chandeleur Islands off the Louisiana coast. The primary nesting sites are located on the beaches of the western and southern half of Florida in the Gulf. Sea turtle nesting areas are depicted in Visual No. 4, of the western and central Gulf visuals.

Table E-2 Species Occurring Both at Platforms and Reef Areas Samples

| Species | Reef Area A | Reef Area B | Reef Area C | Platforms |
|---|---|---|---|---|
| *Sasyatis americana* - Southern Stingray | C [1] | C | C | R |
| *Epinephelus adscensionis* - Rock hind | C | C | C | 0 |
| *E. itajara* - Jewfish | R | | | C |
| *Mycteroperca phenas* - Scamp | C | C | C | C |
| *Apogon maculatus* - Flamefish | C | C | C | 0 |
| *Rachycentron canadum* - Cobia | 0 | | | C |
| *Caranx hippos* - Crevalle jack | C | C | C | C |
| *C. latus* - Horse-eye-jack | C | C | C | C |
| *Elagatis bipinnulata* - Rainbow runner | | 0 | C | R |
| *Selene vomer* - Lookdown | C | 0 | | C |
| *Seriola dumerili* - Greater amberjack | C | C | C | C |
| *Lutjanus campechanux* - Redsnapper | C | C | | C |
| *L. cyanopterus* - Cubera snapper | R | | | R |
| *L. griseus* - Gray snapper | R | | | R |
| *Rhomboplites aurorubens* - Vermilion snapper | 0 | C | C | 0 |
| *Haemulon aurolineatum* - Tomtate | C | | | 0 |
| *Archosargus probatocephalus* - Sheepshead | R | | | C |
| *Equetus umbrosus* - Cubbyu | R | | | R |
| *Kyphosus sectatrix* - Bermuda chub | C | C | | C |
| *Chaetodon ocellatus* - Spotfin butterfly fish | 0 | 0 | 0 | 0 |
| *Holacanthus bermudensis* - Blue angel fish | C | C | C | C |
| *H. ciliaris* - Queen angelfish | 0 | 0 | 0 | 0 |
| *H. tricolor* - Rock beauty | | 0 | 0 | R |
| *Pomacanthus paru* - French angelfish | C | C | C | C |
| *Pomacentrus variabilis* - Cocoa damselfish | C | C | C | C |
| *Amblycirrhitus pinos* - Redspotted harkfish | | 0 | 0 | R |
| *Bodianus pulchellus* - Spotfin hogfish | | | 0 | 0 |
| *B. rufus* - Spanish hogfish | C | C | C | R |
| *Thalassoma bifasciatum* - Bluehead | C | C | C | 0 |

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[1] C = Common
0 = Occasional
R = Rare
(Source: Sonnier et al., in press)

Table E-2 (continued)

| Species | Reef Area A | Reef Area B | Reef Area C | Platform |
|---|---|---|---|---|
| *Sphyraena barracuda* - Great barracuda | C | C | C | C |
| *Scomberomorus cavalla* - King mackerel | C |  |  | C |
| *Aluterus scriptus* - Scrawled filefish |  |  | R | R |
| *Balistes capriscus* - Gray trigger fish | C | C | C | C |
| *B. vetula* - Queen triggerfish |  | R | O | R |
| *Cantherines pullus* - Orange-spotted filefish |  | R |  | O |
| *Canthidermis sufflamen* - Ocean triggerfish | O | C | C | C |
| *Canthigaster rostrata* - Sharpnose puffer | O | O | O | O |
| Totals | 30 | 28 | 25 | 37 |

Table E-3 Species Primarily Associated with Platforms

| Species | 1/ |
|---|---|
| *Epinephelus nigritus* - Warsaw grouper | C |
| *Rypticus maculatus* - Whitespotted soapfish | C |
| *Caranx crysos* - Blue runner | C |
| *Chloroscombrus chrysurus* - Atlantic bumper | R |
| *Vomer setapinnis* - Atlantic moonfish | R |
| *Ocyurus Chrysurus* - Yellowtail snapper | O |
| *Chaetodipterus faber* - Atlantic spadefish | C |
| *Pomacanthus arcuatus* - Gray angelfish | R |
| *Hypleurochilus geminatus* - Crested blenny | C |
| *Acanthurus coeruleus* - Blue tang | R |
| *Aluterus schoepfi* - Orange filefish | R |
| *Monacanthus hispidus* - Planehead filefish | C |

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1/ C = Common
O = Occasional
R = Rare
(Source: Sonnier et al., in press)

The primary problems confronting the turtles in the Gulf are disturbance of nesting sites and drowning in shrimp trawling nets. It is apparent that the general populations are in jeopardy and are probably decreasing.

Several species of marine mammals are recorded for the waters of the Gulf of Mexico, Table E-4. However, most of these records are based on stranded individuals or fortuitous sightings and do not indicate population status.

Schmidly and Melcher (1974), Lowery (1974), and Caldwell (1973) have covered the available data for the Gulf. This spotted dolphin and bottlenose dolphin are the most common small cetaceans and the sperm whale and short-finned pilot whale are the most common larger cetaceans found in the Gulf of Mexico in this assessment area.

The Caribbean monk seal and the West Indies manatee once inhabited the waters of this proposed sale. Since the development of this area for offshore oil and gas both species have become extinct in this area. The overlap of this development and extinction gives further need for caution in areas of oil and gas development inhabited by marine mammals. However, it cannot be shown at the present time whether or not such development either directly (oil pollution, drilling muds, collision with drilling apparatus noise) or indirectly (changes in food chain structure) cause the complete demise of these two mammals from the area. We note that in California, studies on pinnepeds (sea lion) by Schusterman et al. (1972) reported the high sensitivity of California sea lions to underwater sound.

Schneider (1971) recorded noise levels from a drilling platform, ''the noise levels are extremely high at the low frequency end of the spectrum (f=500 $H_2$) and for high thruster RPM's significant noise energy was still contained in frequency components up to 40 KHz''. Noises created by drilling are of very low frequency and may travel up to 1,000 miles underwater (EIS No. 35, Southern California).

While Schusterman et al. (1972) have shown that the California sea lion is sensitive to sound (such as that of an oil platform), we may expect that other pinnepedes such as the monk seal are also sensitive. Loud noises from the drilling area could have precluded the animals from their normal feeding areas, especially the nervous females during breeding time. The noises may have caused enough disruption to cause abandonment of rookeries. In any case the monk seal is now extinct in the area of drilling in the Gulf of Mexico.

**Biological Sensitive Areas**

Three tracts (10, 11, and 61) have been identified in this proposed sale which may contain fishing or hard bank biotic assemblages, based on vertical relief in the area. Tracts 10 and 11 are located in the eastern portion of Sabine Bank. The relief of this area varies from approximately 1.8 to 5.5 meters (C&GS Chart 1116A). Tract 61 has approximately 91 meters of relief. The types of bottom characteristics and biota are unknown.

Table E-4 MARINE MAMMALS OF THE GULF OF MEXICO

| Common Name | Scientific Name |
|---|---|
| *Black Right Whale | **Eubalena glacialis* |
| *Humpback Whale | **Megaptera novaeangliae* |
| Minke Whale | *Balaeoptera acutorostrata* |
| *Sei Whale | **B. borealis* |
| Bryde Whale | *B. edeni* |
| *Blue Whale | **B. musculus* |
| *Fin Whale | **B. physalus* |
| False Killer Whale | *Pseudorca crassidens* |
| Killer Whale | *Orcinus orca* |
| Short-finned Pilot Whale | *Globicephala macrorhyncha* |
| *Sperm Whale | **Physeter catodon* |
| Pygmy Killer Whale | *Feresa attenuata* |
| Pygmy Sperm Whale | *Kogia breviceps* |
| Dwarf Sperm Whale | *K. simus* |
| Antillean Beaked Whale | *Mesoplodon europaeus* |
| Goose-beaked Whale | *Ziphius cavirostris* |
| Rough-toothed Dolphin | *Steno bredanensis* |
| Risso's Dolphin | *Grampus griseus* |
| Common Dolphin | *Delphinus delphis* |
| Bottlenose Dolphin | *Tursiops truncatus* |
| Long-snouted Dolphin | *Stenella longirostris* |
| Bridled Dolphin | *S. frontalis* |
| Euphrosyne Dolphin | *S. caeruleoalba* |
| Spotted Dolphin | *S. plagiodon* |
| Manatee West Indian (Florida) | *Trichechus manatus* |
| California Sea Lion | *Zalophus californianus* |

*Endangered

## Biological Environment of the Coastal Zone

Data on the biological environment of the coastal zone for the western and central Gulf has been treated in previous environmental statements prepared by the Bureau of Land Management. Reference to the following environmental statements are suggested for a more detailed discussion on the biological environment and communities of the coastal zone.

Louisiana—Final Environmental Statement, Vol. 1, OCS Sale No. 36, pp. 122-198
Texas—Final Environmental Statement, Vol. 1, OCS Sale No. 37, pp. 137-175
Gulf of Mexico General Lease Sale—Final Environmental Statement, Vol. 1, OCS Sale No. 41, pp. 132-147

The direct distance along the arc of the Texas coastline between its political boundaries is roughly 595 km. The extent of mainland shoreline, however, as described along its many dendritic bays, is approximately 2,896 km. Eight major bay systems penetrate the Texas coast, and all except the Sabine River estuary are fronted by a portion of a 483 km chain of barrier islands and peninsulas. The uniqueness of this coastal barrier is twofold: It is the longest barrier island system in the world and is comparable in magnitude to the Great Barrier Reef off western Australia; and less than a dozen inlets and passes provide the narrow arteries for exchange between the embayed waters and the open sea.

The seaward margin of the Texas coast, comprised mostly of barrier islands, is a nearly continuous strand of sand beaches. Shoreward of the beaches is the man-made Intracoastal Canal which courses the entire length of the coast. The area of coastal marsh is roughly 1,611 square kilometers, but is limited to a narrow band along the coast with its greatest extent at the Sabine area and then diminishes southward.

The Mississippi contributes nutrients to most of the estuaries of Louisiana—the most extensive in the Gulf—which supports the third largest shrimp production and the second largest oyster production in the United States (U.S. Dept. of Commerce, 1974).

East of the Mississippi Delta, the proportion of estuaries to the coastal zone diminishes and becomes more commonly characterized by high energy sand beaches. The wetlands which are present are extremely valuable in terms of biological productivity.

The paramount feature of this area of the Gulf coast is the Mississippi River Delta and its associated 72.8 million or more hectares of marsh and estuaries. The Mississippi watershed covers about one-third of the United States, and the resultant freshwater discharge is responsible for the major saltwater dilutions within the central Gulf Coast region.

Along the northwest Gulf Coast, the marshlands diminish rapidly into a narrow band along the coast, and are nearly absent in the semiarid regions of south Texas. A significant portion of the coastal zone, however, is composed of a vast system of bays and lagoons which are engendered for the most part by the extensive system of barrier islands. The marshes of this geographic area are depicted in Central Gulf Visual No. 6.

### Salt Marsh

Most salt marshes exhibit distinct zonation by the most abundant plants. This zonation is controlled by a variety of factors including soil types, soil salinity, tide, elevation, drainage characteristics and pH. The extent of saline intrusion into the marsh depends to a large degree on the rate of percolation (movement through soils) of saltwater at high tide (Jackson, 1952), and the location of points of influx of freshwater from the mainland. The saline marsh merges with the broad band of brackish marsh which is further removed from the sea rim and vegetated by wiregrass, coco, and three-cornered grass.

The comparatively small number of plant species of the saltmarsh limits the number of available niches in which organisms may live. Chabreck (1972) recorded only 17 plant species present in the coastal saltmarsh of Louisiana, with saltmarsh cordgrass (*Spartina alterniflora*) being the dominant species. However, with the inland marsh succession, habitat complexity increases significantly.

Salt marsh grass (*Spartina alterniflora*) comprises the most seaward of the vegetation zones where it endures the deepest and longest inundation by salt water. Black rush (*Juncus roemerianus*) inhabits the next zone inland and therefore occurs on slightly higher ground. This species forms almost pure stands to heights of 1.8 to 2 meters and functions to slow down tidal penetration. The third zone inland is dominated by salt grasses (*Distichlis spicata and Spartina patens*). This zone is rarely inundated except during high tides.

Salt marshes support considerable populations of rails, sparrows, ducks, numerous shorebirds and a few reptiles. The area also functions as a hatchery for fish and invertebrates which are essential to the maintenance of the higher vertebrates.

### Brackish Marsh

Brackish marshes are usually situated between the seaward salt marsh and landward intermediate and fresher marshes. These brackish marshes are located extensively in southeastern Texas and throughout the coast of Louisiana.

Salinities vary annually between an average low of 3.4 ppt to an average high of 16.7 ppt. Highest salinities occur in June, or in the drought period (Palmisano, 1971).

Plant species diversity increases as one approaches the upland environment from the marsh. Forty species of plants (Chabreck, 1970) have been recorded in the brackish marsh. The dominant species wiregrass, (*Spartina patens*), comprises 55% of the total vegetation. Saltgrass, (*Distichilis spicata*), makes up 13% of the remaining 38 species. Only five other species have been recorded with coverage greater than two to five percent.

### Intermediate Marsh

Intermediate marshes extend further inland than brackish marshes. In the Gulf of Mexico coastal zone they are distributed predominantly in the southwestern region of Louisiana and southeastern Texas.

A more diverse vegetation occurs in the intermediate marsh than the brackish or saline marshes. Based on the data given by Chabreck (1970), 54 species of plants or 35% more than in the brackish zone occur in the intermediate marshes. The dominant wiregrass makes up a third of the vegetation. Roseau (*Phragmites communis*), and bulltongue (*Sagittaria falcata*), comprise 6.6% and 6.5% of the vegetation, respectively.

### Freshwater Marsh

There are several freshwater marshes in the area of the proposed sale. The major freshwater marsh is centrally located in the Mississippi Delta near the distributary passes. Other freshwater marshes in the proposed sale area are Sabine Lake, Atchafalaya River and at the mouth of the Trinity River in Galveston, Texas. Major species of vegetation in this marsh are: roseau cane, Eurasion water milfoil, alligator weed, duck weed, water hyacinth, dogtooth grass, bulltongue, and pondweed (Stone, 1972).

### Barrier Islands

Several groups of barrier islands front the coastal states of Texas and Louisiana. Many offer environments distinct from the other island groups. Following is a list of the major barrier islands for the western and central Gulf of Mexico.

1. Padre Island—Texas
2. Mustang Island—Texas
3. Matagorda Island—Texas
4. Galveston Island—Texas
5. St. Joseph Island—Texas
6. San Jose Island—Texas
7. Baazos Island—Texas
8. Grande Terre Islands—Louisiana
9. Isles Dernieres—Louisiana
10. Timbalier Islands—Louisiana
11. Grande Isle—Louisiana
12. Chandeleur Islands—Louisiana

### Seagrasses

Seagrasses consist of species of flowering plants that grow completely submerged (some are tidally emergent) in brackish to saline waters. They are limited to water where sunlight penetration permits photosynthesis, such as are found in the shallow waters of bays and around islands in areas of low turbidity.

Marine grass beds support one of the highest biomass densities in the marine environment. They not only provide a valuable food source for migratory waterfowl and shorebirds, but are also prime nursery grounds for shrimp, crabs and fishes of all types. While few animals feed on the grasses, many feed on organisms which attach to or live on them; viz., snails and mussels.

Seagrass communities are fragile ecosystems which advance and decline readily in response to minor changes in water quality, turbidity, or sediment loads and are vulnerable to storm damage. The U.S. Fish and Wildlife Service (personal communication) reported that the largest of these marine meadow communities in Louisiana is located immediately west of the Chandeleur Islands from Whitehouse Point south to the area of Polo Island. Species include *Syringodium filiforme*, *Thalassia testudinum*, *Halodule beaudetti*, *Halophila engelmanni* and *Ruppia maritima*. Extensive areas of the Laguna Madre in Texas are carpeted by *Diplanthera wrightii* while *Ruppia* *maritima* is common in sheltered coves. *Thalassia testudinum* is limited to areas of the southern Laguna and *Syringodium filiform* is rare. *Thalassia* and Diplanthera are common in estuaries of the central Texas coast, while *Ruppia* and *Diplanthera* are most common along the east Texas coast.

### Estuaries and Embayments

Estuaries and bays are highly productive ecosystems. They receive nutrients from upland areas via major river systems, especially during spring flooding. They also receive the nutrient wash-out from tidal flushing of the salt marsh, particularly in mid-winter when marsh grass of the previous season is decomposing. The dynamics of this system holds for the estuarine areas of Louisiana. Diagrammatic cross sections including a listing of representative invertebrate species are shown in Figure F-1 (Collard and D'Asaro, 1973).

### Beaches

Much of the Texas and Louisiana coastline is protected from the full force of oceanic waves by barrier islands. The seaward margins of these islands, which are exposed to waves formed at sea, are called high energy beaches. Organisms living in such areas are adapted to survive the scouring force of wave action by burrowing the sand. The sand bug (*Emerita talpoida*), and the butterfly shell, variable wedge shell (*Donax variabilis*), etc., (among others) these organisms can bury themselves almost instantaneously. This ability enables them to live directly in the surf zone (Collard and D'Asaro, 1973). Figure F-2 depicts many of the same invertebrates found west of Louisiana.

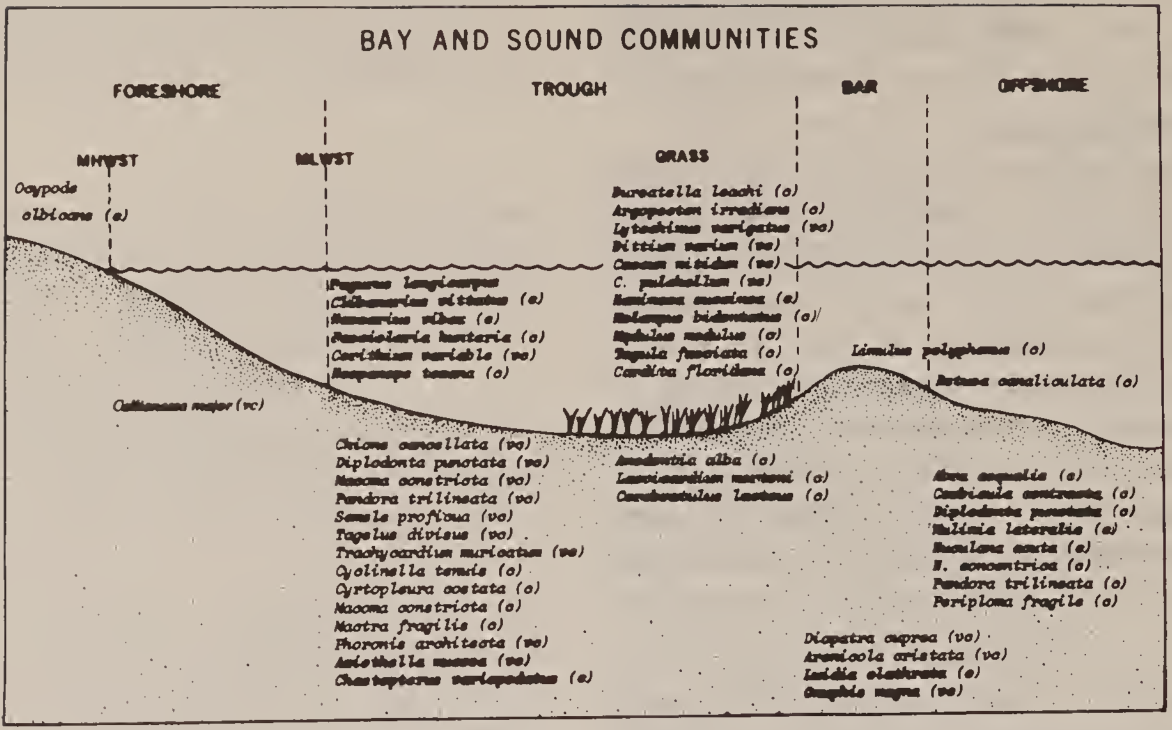


Figure F-1 Bay and sound communities: Carolinian affinities. Most species listed are wide ranging, occurring in sand and grass. Typical of northern Gulf Coast from Louisiana to Cedar Key, Florida (from Collard and D'Asaro, 1973).

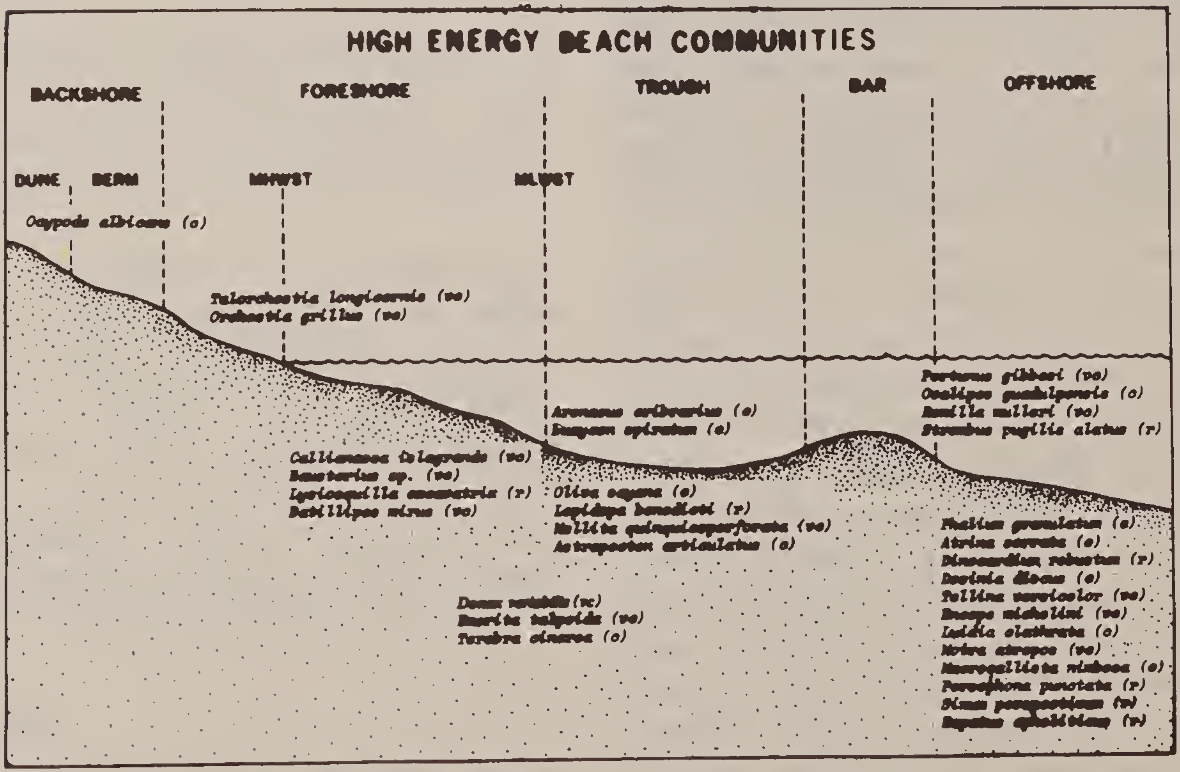


Figure F-2 High Energy Beach Communities. Composition of these communities is essentially the same from the Mississippi barrier islands to Cape Sable, Florida (from Collard and D'Asaro, 1973).

## Human Utilization

### Land Use

Land use information is available for portions of the coastal zones of Texas and Louisiana, but at varying scales, specifications, interpretations and stages of completion. For some regions, detailed land information is available, but formats are often inconsistent with adjacent regions. For the purpose of this discussion, therefore, only references which allow a generalized and consistent overview of the Texas and Louisiana coastal zone were used.

### TEXAS

The most comprehensive and current land use and ownership mapping, statistical inventories and descriptions for coastal Texas can be found in the Environmental Geologic Atlas of the Texas Coastal Zone (Fisher, et al., 1973) which delineates the coastal line into seven reaches. All the maps in this series are now available from the Texas Bureau of Economic Geology, although the accompanying textural material has not been published for all areas.

Land use in the Texas coastal zone is highly variable both within and between regions and this requires its portrayal in general categories at gross scales. More detailed categorical discussions can be found elsewhere under appropriate headings.

In the upper reaches, land use pressures are generally more intense because of the major population and industrial centers in that region as described in the Environmental Geological Atlas of the Texas Coastal Zone—Beaumont—Port Arthur Area (Fisher et al., 1973). A number of factors contribute to diversified and intensive land and water use, especially in the Houston, Galveston, Beaumont, Port Arthur and Orange areas. First, it is an area amply endowed with mineral resources which supports one of the major petroleum refining and petrochemical centers of the world. Secondly, it is an area with fertile and productive agricultural lands and, finally, it contains major port facilities with extensive intracoastal waterways and ship channels that have led to a high-volume flow of imports and exports.

Many of the factors have led to diverse land and water use in the Beaumont-Port Arthur area and have also led to current and potential limitations and conflicts. Many of the resources of the area have varied uses, both present and potential. For example, water bodies are used simultaneously for transportation, commercial and sport fishing, recreation, oil and gas well locations, pipeline routes, as an area to fill for real estate development, and as a part of a waste disposal system. The importance of wetlands for aquatic organisms and as a source of organic input into aquatic ecosystems is now well understood, and has resulted in the enactment of legislation designed to prevent destruction of valuable wetland habitat unless it is in the overall public interest, has no feasible alternative, and is conducted in the most environmentally acceptable manner possible.

The area is undergoing rapid and dramatic physical change involving active shoreline processes, hurricane flooding and damage, subsidence and surface faulting. These changes conflict with a variety of land and water uses.

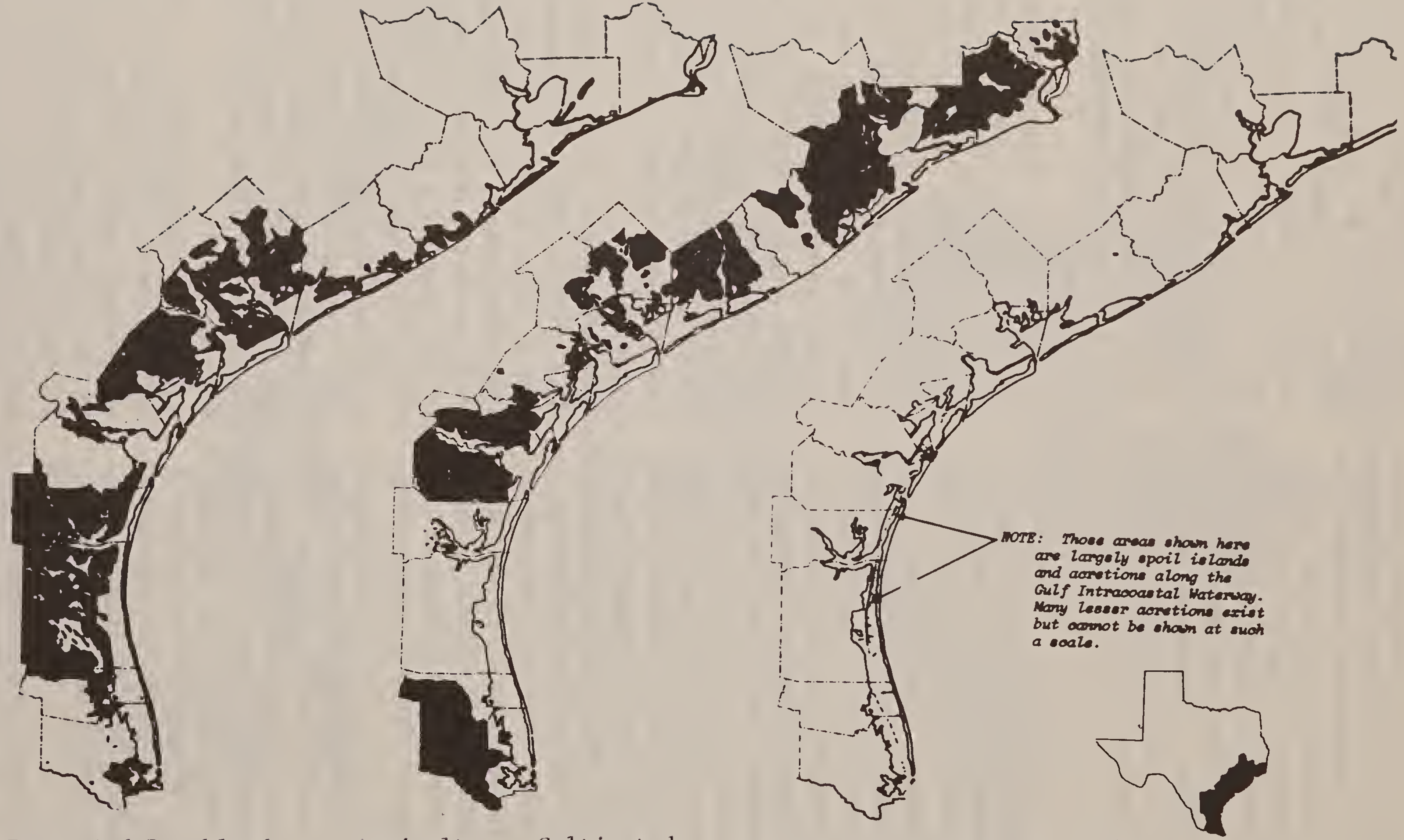
In the lower reaches of the Texas coastal zone, many of the specific land uses are similar, but the acreage proportions differ from the upper reaches. Urban and industrial stress is less intense, and with the exception of the developed areas near Brownsville, Harlingen and Corpus Christi land use is generally more extensive, with large acreages devoted to agriculture, rangeland and ranching.

Patterns of land use and intensity can be found in a report, Land Use Patterns in the Texas Coastal Zone, (Flawn and Fisher, 1970). Highly generalized patterns of gross categories are shown in Figures G-1, 2 and 3 and a statistical summary of these acreages is shown in Table G-1. The following is a summary of the coastal counties.

A brief discussion of these principal land and water uses and their distribution within the 18 county coastal zone follows. A more comprehensive discussion can be found in the Final Environmental Impact Statement FES 74-63 written for OCS Sale No. 37.

Agriculture—Approximately 13,261 sq. km (41%) of the total land in the Texas coastal zone are presently under cultivation. Concentration is on the original prairie grasslands of the central and upper coastal zone. Agricultural use becomes less intensive in the south Texas coastal zone with the progressive decrease in rainfall.

Sixty percent of the total production of rice in Texas comes from the coastal zone. The main producing counties are Brazoria, Chambers, Harris, Jackson, Jefferson and Matagorda. Relatively



NOTE: Those areas shown here are largely spoil islands and accretions along the Gulf Intracoastal Waterway. Many lesser accretions exist but cannot be shown at such a scale.

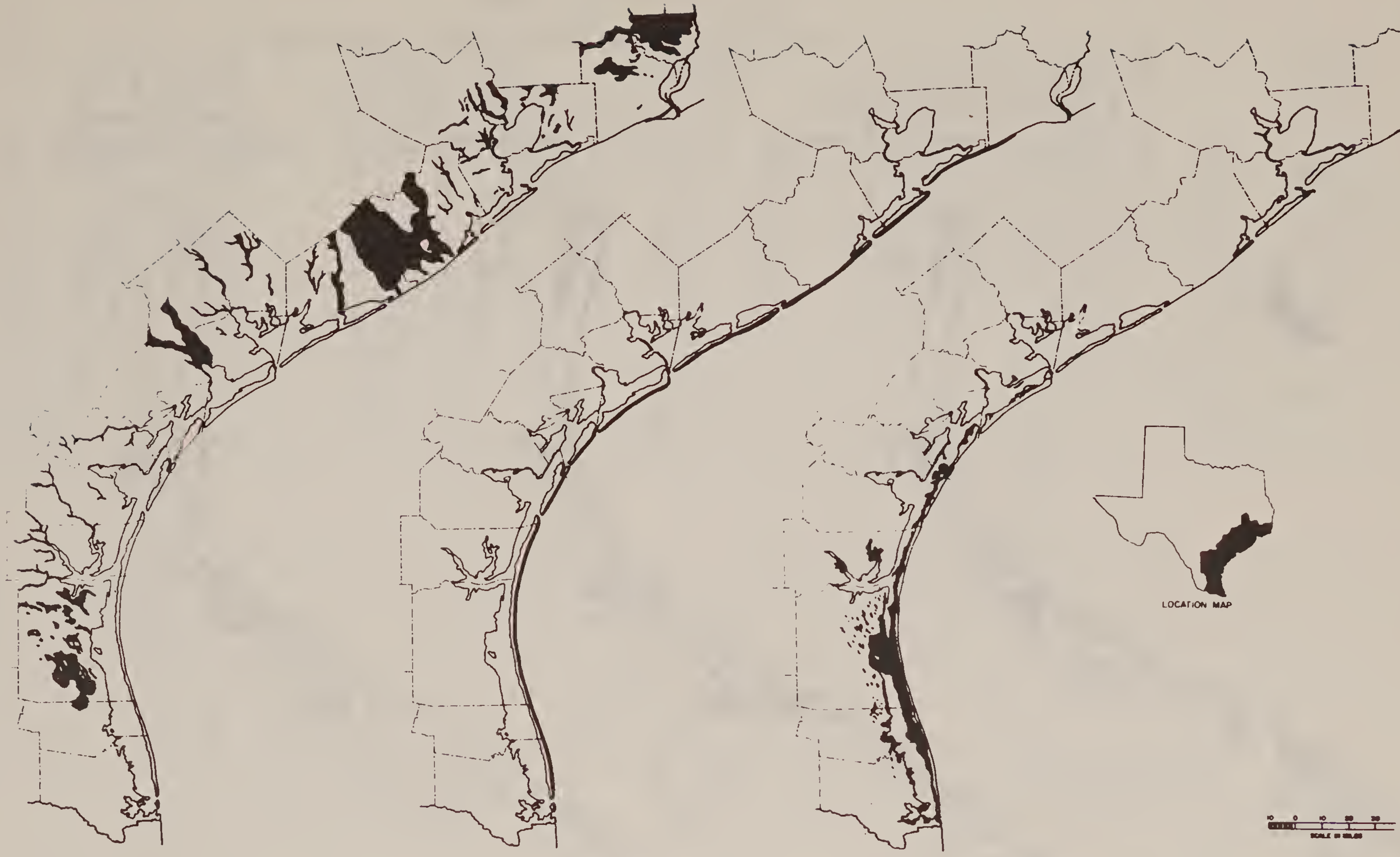
Range And Ranchland In The Coastal Zone

Agriculture: Cultivated Lands In The Coastal Zone

Spoil Islands And Other Built-Up Lands In The Coastal Zone

Figure G-1 LAND USE IN THE COASTAL ZONE

(Flawn and Fisher, 1970)



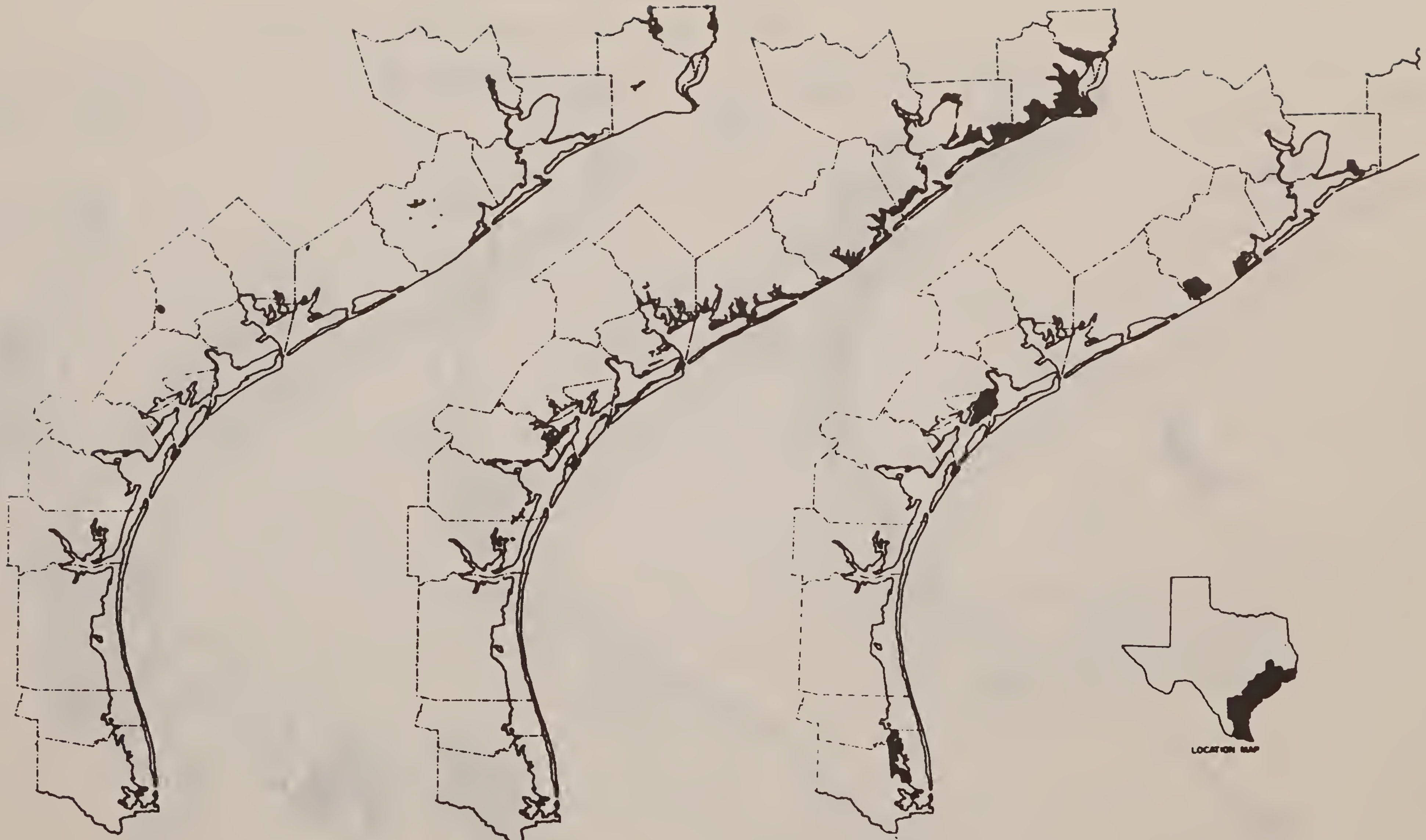
TIMBER - WOODLANDS IN THE COASTAL ZONE

RECREATIONAL BEACHES IN THE COASTAL ZONE

BARREN LANDS IN THE COASTAL ZONE

Figure G-2 LAND USE IN THE COASTAL ZONE

(Flawn and Fisher, 1970)



Swamplands In The Coastal Zone

Marshlands In The Coastal Zone

Formal Wildlife Refuges In The Coastal Zone

Figure G-3 LAND USE IN THE COASTAL ZONE (Flawn and Fisher, 1970)

Table G-1 Statistical Summary of Land Use - Texas Coastal Counties

| Use | Totals |
|---|---|
| Total area 1/ | 16128.0 |
| Total land area 2/ | 13818.0 - 86.0 |
| Total water area 2/ | 2310.0 - 14.0 |
| **Land Areas** | |
| Agriculture 3/ | 5117.0 - 37.0 |
| Range and ranch 3/ | 4425.0 - 32.0 |
| Woodland and timber 3/ | 1609.0 - 11.6 |
| Marsh and Swamp 3/ | 762.7 - 5.5 |
| Urban industrial and residential 3/ | 969.7 - 7.0 |
| Recreational 3/ | 23.3 - 0.2 |
| Subaerial spoil 3/ | 84.7 - 0.6 |
| Made land 3/ | 33.8 - 0.2 |
| Wildlife refuge 3/ | 213.4 - 1.5 |
| Barren land 3/ | 579.4 - 4.2 |
| **Water Areas** | |
| Bays 2/ | 2075.3 - 12.9 |
| Artificial reservoirs 1/ | 64.7 |
| Natural fresh water bodies 1/ | 170.0 |
| **Other Features** | |
| Bay shoreline 4/ | 1419.3 |
| Open ocean shoreline 4/ | 373.1 |
| Total shoreline 4/ | 1792.4 |
| Drainage channels 4/ | 3120.0 |
| Transportation canals 4/ | 668.0 |
| Hurricane flood areas 4/ | 3208.0 - 23.3 |

1/ Measured in square miles.
2/ Measured in both square miles (left number) and % of total area (right number).
3/ Measured in both square miles (left number) and % of total land area (right number).
4/ Measured in linear miles.

Source: Flawn and Fisher, 1970

high rainfall and extensive irrigation are main contributing factors.

The second most important agricultural crop produced in the coastal zone is grain sorghums, accounting for about 12% of the total state production. Principal yields are centered in the Corpus Christi area (Nueces and San Patricio counties) and in the southernmost part of the coastal zone (Willacy and Cameron counties).

Use of the coastal zone land in the production of cotton is significant only in the coastal bend (Calhoun, Nueces, and San Patricio counties) and in the lower Rio Grande Valley (Willacy County).

Minor quantities of corn, hay, oats and wheat are produced accounting for less than three percent of the total state production. Concentration of crops is in the central coastal zone (Matagorda, Brazoria and Harris counties) and is co-extensive with the area of principal beef production.

Range and ranchland: Approximately 42% 11,461 sq. km of the total area of the coastal zone is devoted to range and ranch sites; marshlands used as range sites include an additional 1,968 sq. km. Principal sites include the more arid region of south Texas, the low-lying coastal marshes, and the nonwooded barrier islands and levees of the central and upper coastal zone. The grazing of beef is the principal use of the range land and is most significant in Brazoria, Harris, Jackson, Matagorda and Victoria counties.

Woodland and timber: Woodlands occur throughout the coastal zone of Texas but are most extensive in Orange, Brazoria, Matagorda and Kenedy counties. Smaller areas of woodlands occur along streams, including low-swamp areas with water-tolerant vegetation, and on certain of the abandoned Pleistocene barrier island sands. Total woodland area in the coastal zone is approximately 4,144 sq. km. Principal vegetation in the upper coastal zone woodlands includes pine and mixed hardwoods; in the central coastal zone, a variety of water-tolerant hardwoods; and in the southern coastal zone, oak.

Marshlands: Approximately 1,968 sq. km of the Texas coastal zone is marshlands or wetlands. These include dominantly low-lying areas, the landward sides of barrier islands, and low areas at the terminus of major river valleys and associated bayhead deltas. Salt, brackish, and fresh-water marshes are restricted to areas below four feet above mean sea level. Grasses of varying tolerance to fresh and salt water are the sole vegetation. Most of the marshlands are used for the grazing of beef cattle.

Urban industrial and residential: The principal urban and industrial concentration is in the upper part of the coastal zone. Highest concentrations are in Jefferson (Port Arthur area), Galveston (Galveston area), Harris (Houston area), Brazoria (Freeport area), and Nueces (Corpus Christi area) counties. Nearly 2,590 sq. km are included in this use category.

Recreation: The area designated as recreation is primarily the public beaches of the coastal zone. This amounts to a total area of about 60 sq. km. Not included are a variety of public parks and other recreational areas, surface waters and the Padre Island National Seashore.

Formal wildlife refuges: (Source: Texas A & M University, 1972). Five major national wildlife refuges are designated in the Texas coastal zone including: Anahuac Refuge (4,023 hectares) in Chambers County; Brazoria (3,857 hectares) and San Bernard (6,038 hectares) refuges in Brazoria County; Aransas Refuge (22,190 hectares) in Calhoun, Aransas and Refugio counties; and Laguna Atascosa Refuge (18,272 hectares) in Cameron County. There is one state owned wildlife management area, the J. D. Murphee Wildlife Management Area (3,400 hectares) in Chambers County.

Barren lands: Barren lands comprise nearly 1,502 sq. km in the coastal zone. Principal distribution of these lands is in the semiarid area from Kleberg County south, and includes extensive wind-tidal flats landward of Padre Island as well as some of the active dune fields on the south Texas sand sheet.

Made land and spoil: Made land, or land built up to higher levels by grading, represents about 88 sq. km in the coastal zone. This occurs principally in metropolitan areas along the coast. Some of the spoil areas have re-established vegetation; other areas are barren.

Water: The extensive bays of the coastal zone comprise the principal surface-water bodies covering approximately 5,439 sq. km and making up about 13% of the total surveyed area. Principal bays and estuaries include Sabine Lake; Trinity-Galveston Bay, including East and West Bays; Matagorda Bay, including East Matagorda Bay; Espiritu Santo Bay; Lavaca Bay; San Antonio Bay; Aransas Bay; Copano Bay; Corpus Christi Bay; Baffin Bay; and Laguna Madre.

Fresh water bodies existing either as natural water bodies or as artificial reservoirs comprise the other water areas of the coastal zone. The surface area of natural water bodies is about 4,403 sq. km; artificial reservoirs cover about 168 sq. km.

Hurricane flood: Approximately 8,309 sq. km of the lower parts of the Texas coastal zone have been inundated by salt water from surges of hurricanes Carla and Beulah during the past decade. Particularly prone to flooding are the low coastal marshes and the lower reaches of the main river valleys.

Shoreline: Total shoreline in the Texas coastal zone amounts to slightly over 3,041 km. Of this total, 2,283 km are bay shoreline and 151 hectares open-ocean or gulf shoreline. The shoreline is a dynamic zone subject to constant change in the form of erosion or accretion and is thus subject to change in total length.

Canals: An extensive canal system has been developed in the Texas coastal zone including transportation, irrigation and drainage canals. Major transportation canals total 1,075 km within the surveyed part of the coastal zone. Approximately 5,020 km of irrigation and drainage canals have been cut, mostly associated with agricultural lands.

Specific to the immediate shoreline is a land use study (Texas A & M University, 1972), which divided the coast into beach segments (Fig. G-4) for the purpose of describing shoreline use. Each section of the coast is 4.8 km in length along the beach and extends from the ocean beach back to the approximate limit of hurricane high water, which was assumed to be 3.7 m elevation. The following description of the physical and land use characteristics along the Texas coastal shoreline was abstracted from this study.

Shoreline segments 1-40: Padre Island, a barrier island between the Gulf of Mexico and Laguna Madre, extends south along the lower Texas coast for about 182 km ranging in width from a few hundred yards to about 4.8 km. It has wide, sandy beaches backed by sand dunes up to 12.2 m, grass flats and mud flats.

The long mainland shore of Laguna Madre, extending south about 188 km from Encinal Peninsula to Port Isabel, is essentially underdeveloped privately owned land. The area adjacent to the shore is largely unpopulated. Baffin Bay has some private residences and recreational facilities along its west bank. Port Mansfield is a sport and commercial fishing center with harbor facilities for fishing vessels and small craft. The community has a small number of permanent residents operating establishments catering to tourists, hunters and fishermen. Laguna Atascosa National Wildlife Refuge borders a large portion of the Laguna Madre shore between the mouth of the Arroyo Colorado and a point about 12.9 km north of Port Isabel. Between the wildlife refuge and Port Isabel much of the area has been subdivided for homes. The Port Isabel waterfront is lined with hotels, docks, piers, boat launching ramps and seafood handling and processing establishments.

Brazos Island and the South Bay area between Port Isabel and the Rio Grande are mostly undeveloped. The Gulf shore of Brazos Island, including a 3.2 km strip dedicated as a state park, is used for public recreation. Some private housing and a few tourist service establishments are located along this coast.

Except for some public recreational and private residential and commercial developments at its northern and southern extremities, there are no other significant developments on Padre Island.

The federal navigation channel from the Gulf of Mexico to Port Mansfield extends through Padre Island about 61 km north to Port Isabel. Most of the island north of the Port Mansfield Channel is occupied by the Padre Island National Seashore, a park 129.5 km long dedicated to preserving that portion of the island in its natural state for the public's enjoyment.

Shoreline segments 41-51: The major portion of St. Joseph Island is used for ranching and private recreation. A small portion of the southern tip of the island, adjacent to the Aransas Pass Navigation Channel, is owned by the Federal Government. Mustang Island extends from the Aransas Pass Navigation Channel to Corpus Christi Pass. The 26 km long beach front is a very popular recreational center for the south Texas region. Sand dunes up to 7.6 m in height lie behind the beach front. The island provides protection against hurricane tides and waves for the island areas around Corpus Christi Bay. The island has numerous beach homes and recreational facilities. Port Aransas, located on the northern end of the island, is the only town on Mustang Island.

A causeway and ferry provide access to the northern end of the island while the John F. Ken-

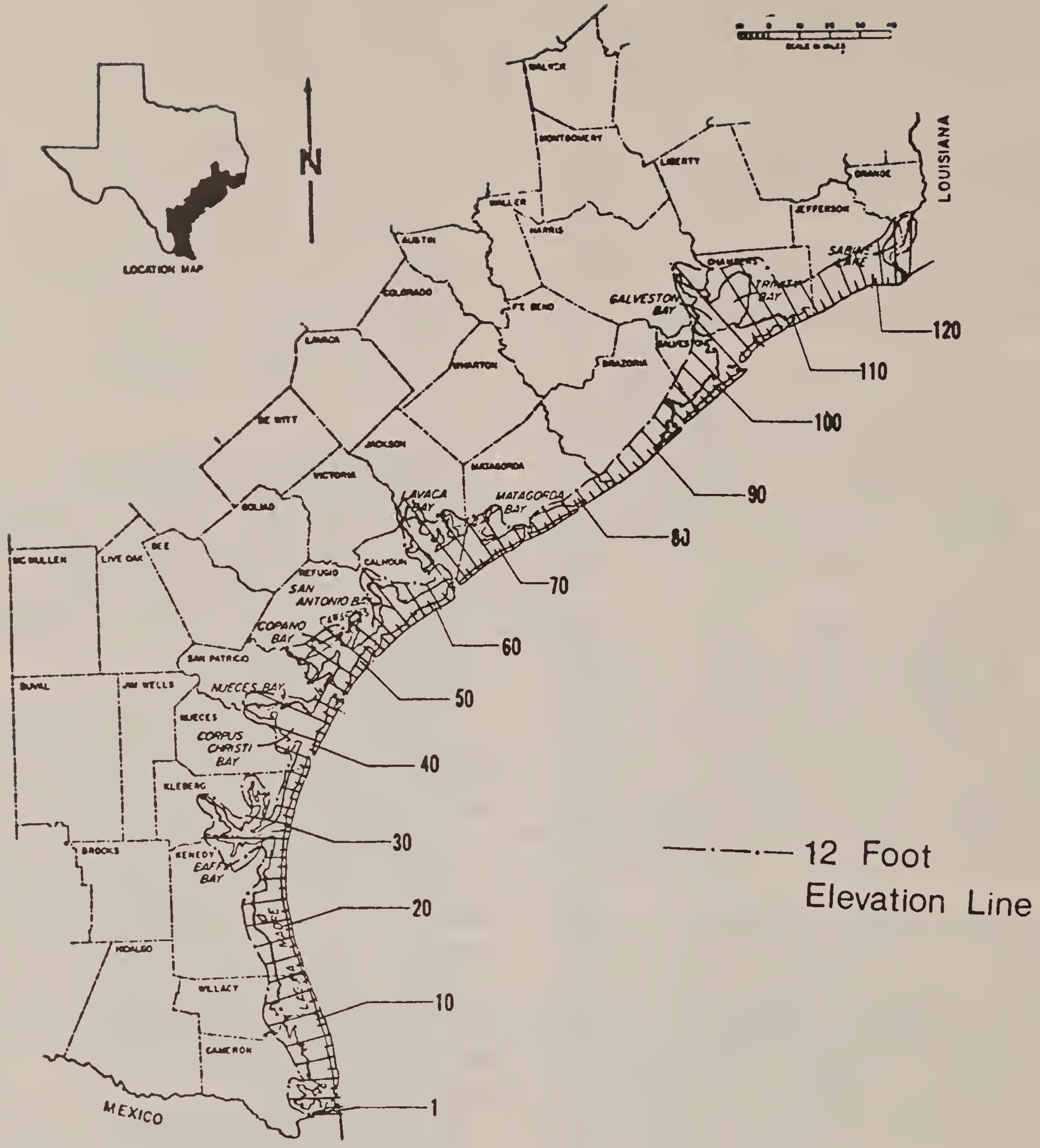


FIG G-4 Three-mile Environmental Inventory Shoreline Segments.

nedy Causeway provides access to the south end. The north shore of Mesquite Bay and the east shore of Blackjack Peninsula are part of the Aransas National Wildlife Refuge. The west bank of St. Charles Bay is undeveloped. The perimeter of Copano Bay has scattered developments of homes, fishing and hunting camps, farm buildings, and oil fields and supporting facilities. Most of the northwest shores of Aransas and Redfish Bays are well developed with homes. The cities of Rockport and Aransas Pass have many businesses catering to tourists and recreationists. Oil fields and permanent and summer residences occupy the northeast shore of Corpus Christi Bay. The northwest shore of the bay has several residential subdivisions on bluffs which range up to nine km above sea level. Oil and gas wells, piers and docks constitute the major development on the north shore of Neuces Bay. Much of the shore of Neuces Bay is undeveloped and is used as a spoil area for dredging operations in the Corpus Christi Ship Channel.

Corpus Christi, the largest city on the Texas coast, fronts the west and south shores of Corpus Christi Bay about 26 km of highly developed and densely populated urban areas. Corpus Christi is an important sea port and industrial center for petroleum and agricultural products and is also a major tourist and convention center.

A large part of the Oso Bay is not developed. The University of Corpus Christi occupies an island connected to the mainland by a causeway at the shore of Laguna Madre. Part of the Corpus Christi Naval Air Station, the community of Flour Bluff and a small port serving fishing interests and nearby oil and gas fields is located along the Encinal Peninsula shore. Many boating supply, bait, and fishing tackle businesses and launching ramps are located along the John F. Kennedy Causeway.

Shoreline segments 52-61: Matagorda Island is a remote area accessible only by boat or aircraft. About 60 percent of the 48 km long island was occupied by the Matagorda Island Air Force Base and Gunnery Range. The southwestern end of the island is devoted to ranching. The shoreline of Espiritu Santo, San Antonio, Guadalupe and Hynes bays are, for the most part, undeveloped. South of the town of Seadrift, the land is quite low and unsuitable for permanent type structures. Most of the upper part of San Antonio Bay is bordered by the low, marshy delta lands. The west shore of San Antonio Bay is undeveloped, except for the town of Austwell and a few scattered residences. The Aransas National Wildlife Refuge occupies the shore of San Antonio Bay from Webb Point to False Live Oak Point.

Shoreline segments 62-73: Matagorda Peninsula has the only Gulf shore in this zone. The peninsula, accessible only by boat or aircraft, is used primarily for ranching and recreation. Overnight camping is quite popular in the area near the Matagorda jetties. Two private airstrips are located on the peninsula. Most of the perimeter of Matagorda Bay is sparsely populated marshland devoted to grazing except for the town of Port O'Connor and other small communities on the western shore. The western shore has beach areas which are used for recreation where public access is available. Near Well Point, on the north shore of Matagorda Bay, about 366 km of the shore is occupied by the Texas Parks and Wildlife Marine Biology Laboratory. Farm and ranch lands border a large portion of Tres Palacios Bay Shoreline. The south part of the east shore of Lavaca Bay is low, undeveloped land. The remainder of the shore is comprised of banks and bluffs up to 7.6 m high except for some marsh area at the mouths of several streams entering the bay. The city of Port Lavaca is the largest populated area on the bay.

Shoreline segments 74-86: The northeasterly end of the Gulf shore in this area is undeveloped. It is remote and not easily accessible, but used for camping, bathing, and fishing when beach travel conditions permit. The Cedar Lakes area is undeveloped. Some areas near the mouth of Caney Creek are subdivided for beach homes. Matagorda Peninsula, southwest of the mouth of Caney Creek, is used mostly for grazing. Numerous summer homes are located in the more accessible areas near the mouth of the Colorado River. The shores of Matagorda Bay east of the Colorado River are generally undeveloped.

Shoreline segments 87-90: Shoreline development of the eastern half of this zone consists of permanent and summer homes and recreation oriented businesses. The city of Freeport and its adjacent heavy industrialization are located here. The area westward of the Freeport Harbor navigation entrance is mostly undeveloped since it is accessible only by a single road and a pontoon bridge across the Gulf Intracoastal Waterway. The beach does, however, receive some recreational use.

Shoreline segments 91-111: This zone includes the largest concentrations of shoreline development along the Texas coast. The large Galveston Bay System, comprising Galveston Bay, East Bay, Trinity Bay, West Bay and several smaller bay arms, lies behind the barrier formations of Bolivar Peninsula, Galveston Island and Follets Island. A considerable part of Bolivar Peninsula is occupied by permanent and summer residences and numerous commercial establishments. The city of Galveston occupies about the easterly one-third of Galveston Island; the westerly two-thirds of the island has many permanent and summer-home type residential developments. A number of similar developments are located on Follets Island, west of San Luis Pass. The westerly shore of Galveston Bay is occupied by almost continuous urban development from Texas City to La Port and Baytown. Seabrook, Kemah, San Leon and a number of unincorporated communities line the bayshore in this reach. The city of Anahuac is located on the westerly shore of Trinity Bay near the mouth of the Trinity River. The Anahuac National Wildlife Refuge borders about 10 km to the north shore of East Bay.

The East Bay shoreline of Bolivar Peninsula is extensively used for recreational boating and fishing. The north shore of East Bay is mostly unoccupied except for residential development on Smith Point.

The shores of Trinity Bay are mostly undeveloped excepting the Anahuac vicinity and the vicinity of Umbrella Point and Houston Point on the north shore where numerous homes, boating and fishing camps, and some oil industry facilities are located. The upper end of Galveston Bay near Baytown is highly developed. Most of the shores are occupied by industrial, commercial and residential properties. The Galveston Bay shoreline from Morgan Point to Texas City, including the shore of Clear Lake and some of Dickinson Bay, is extensively developed with permanent and summer residences and some commercial establishments. The shoreline outside of the Texas City Hurricane Flood Protection System is, for the most part, undeveloped. The northerly shores of West, Bastrop and Christmas bays are undeveloped except for a few summer home type subdivisions.

Galveston Island has about 51 km of Gulf shoreline which is used heavily for recreation. About 16 km of the Gulf shore of the city of Galveston is protected by a massive concrete seawall. Most private property along the seawall is highly developed with hotels, motels, apartments, restaurants, tourist attractions and other businesses. The north portion of the city of Galveston and the south shore of nearby Pelican Island are occupied by marine and industrial facilities related to fishing, shipping and offshore oil exploration. The area is rapidly changing from sparsely settled grazing lands to subdivisions for summer and permanent homes. Follet's Island, west of San Luis Pass, is about 15 km long and is occupied by many permanent and summer homes.

Shoreline segments 112-124: The shores of this most easterly zone are mostly undeveloped. Within the city limits of Port Arthur on the northwest shore of Sabine Lake, there are some recreational developments principally for boating and boat racing. Two small towns are located near the Gulf, south of Port Arthur. The westerly portion of the Gulf shore is used extensively for public recreation, although virtually no facilities have been provided for public use or access.

### LOUISIANA

Forty-five percent of the State of Louisiana consists of coastal and floodplain wetlands (Louisiana Planning Corporation, 1972, Vol. 1, pp. 235-236). Of the 12 million hectares of estuarine water and wetlands nationally, Louisiana has over 2.8 million hectares—more than any other state. These wetlands are primarily located in the Mississippi River Valley. The coastal marsh zone occupies a broad band of land from the State's Texas to Mississippi borders along the Gulf of Mexico (central Gulf, visual 5, Vol. 3). In these wetlands, and in the remainder of the coastal zone, lie the majority of Louisiana's people and industry. The activities of the people, their work and play, are closely tied to the use of the resources of the coastal zone (Louisiana Adv. Comm. Coastal Mar. Res., 1973a, p. 19).

The wetlands contain 80 percent of the manufacturing and some of the most valuable mineral resources of the region and of the United States. Large quantities of petroleum, natural gas, sulphur and salt are extracted. Together, activities of coastal and marine-related businesses provide more than 50 percent of Louisiana's tax revenues. Eighty percent of the State's population is located within the wetlands.

Opportunities for development offered by the Louisiana coastal area include the presence of rich oil and gas resources, agricultural lands, wildlife resources which support trapping and recreational activities, valuable fishery resources, and the proximity of the Mississippi River which serves as an important transportation route. These opportunities have given rise to industrial, urban and agricultural development, which in turn have supported population increases.

Table G-2 indicates the land use in coastal Louisiana by acres. It can be seen that marshlands comprise 63 percent of the land area of the coastal parishes. These marshlands are essential habitat for numerous economically important species of fish and wildlife and are the site of wildlife refuges and game management areas.

The following discussion will cover the major components of the environment and their condition as they presently exist in the coastal zone. This discussion relies heavily on the work conducted at the Center for Wetland Resources at Louisiana State University (Gagliano, 1972) and the Atlas of Louisiana, Miscellaneous Publication 72-1 (Newton, 1972).

### BARRIER ISLANDS, REEFS AND GULF SHORE AREAS

These areas represent the first line of defense against storms and marine processes, regulating inflow and outflow of Gulf waters, are valuable as wildlife habitats and recreation areas. They are vulnerable to erosion and hurricane damage.

Barrier islands, reefs and gulf shore areas extend along the entire Louisiana coast except for that part of the Mississippi Delta lying seaward of a line extending southwest of Breton Island.

There are two towns lying in this zone, Cameron in Southwest Louisiana, and Grand Isle in the Southeast. This zone also supports numerous but isolated fishing and trapping camps.

### FRESH, INTERMEDIATE, BRACKISH AND SALINE MARSH AREAS

These areas are extremely important as habitat for fish and wildlife, are an important component of the estuarine zones, are important recreational areas, and serve as buffer zones against storm generated surges.

Marsh areas extend along the entire coastline of Louisiana. They lie behind the barrier islands, reefs and gulf shore areas, or front directly on the Gulf as along the outer parts of the Mississippi delta. This area is used extensively for hunting, fishing and trapping, and supports many isolated base camps.

### ESTUARINE NURSERY AREAS

These areas are the most biologically productive areas of the state, essential to the fisheries, and provide habitat for wildlife. This zone supports an extensive commercial as well as sport fisheries, the nature of which is more extensively discussed in other appropriate sections.

## Ocean Dumping Areas and Military Use

### OCEAN DUMPING

Ocean dumping under the 1972 Marine Protection Research and Sanctuaries Act is regulated by permits issued by the United States Environmental Protection Agency. In May, 1973, a list of approved interim dumping sites was published in the Federal Register. Table G-3 shows those approved interim sites located in the Gulf of Mexico.

To date, two permits have been issued for dumping of industrial chemical wastes; one to Texas Shell Chemical Company and another to Louisiana Ethyl Corporation. An additional site was cleared for incineration of chemical wastes by Shell Chemical Company. The geographic coordinates of these three sites are as follows:

Texas Shell Chemical Company—27°12′ N - 27°28′ N; 92°28′ W - 94°44′ W (812,160 Ac)
Louisiana Ethyl Corporation—28°00′ N - 28°10′ N; 89°15′ W - 89°30′ W (86,400 Ac)
Shell Chemical Company (Incineration Site)—26°20′ N - 27°00′ N; 93°20′ W - 94°00′ W (823,680 Ac)

### MILITARY USES OF THE CONTINENTAL SHELF

The Gulf of Mexico is used rather extensively by the Navy and Air Force for conducting military training, testing and research activities. These current activities consist of missile testing, ordnance testing, drone recovery operations, pilot training and electronic counter measure (ECM) activities by the Air Force. Mine research activities are conducted by the Department of Navy. Most of this activity takes place in areas designated for these purposes. However, live ordnance testing by the Air Force occasionally involves emergency release of ordnance outside designated bombing areas. These ordnances range from small munitions to 544 kg pound bombs. The possibility of occurrence of unexploded munitions on the ocean floor in the proposed sale area is not remote in certain locations. Potential for interference with military training and testing activities

Table G-2 Land Use in Coastal Louisiana
( No. of Acres)

| Parish | Total Area | Water Area | Marsh-land | Forest Land | Agri. Land | Urban Land | Trans-port | Aggre-gate Land Ar. | Unac- 4/ counted Acreage | Area Percent |
|---|---|---|---|---|---|---|---|---|---|---|
| Cameron | 1,087,360 | 194,101 | 739,474 | - | 269,492 | 180 | 2,332 | 1,011,478 | -118,219 | -10.9 |
| Iberia | 414,080 | 49,050 | 115,164 | 115,000 | 129,618 | 5,210 | 4,805 | 369,797 | -4,767 | -1.2 |
| Jefferson | 382,720 | 136,960 | 157,237 | - | 7,379 | 24,030 | 2,838 | 191,484 | 54,276 | 14.2 |
| Lafourche | 865,920 | 168,239 | 390,742 | 156,000 | 179,339 | 3,320 | 3,884 | 733,285 | -35,604 | -4.1 |
| Orleans | 232,320 | 112,460 | 59,930 | - | 1,055 | 37,995 | 30,941 | 129,921 | -10,061 | -4.3 |
| Plaquemines | 895,360 | 322,788 | 494,101 | - | 53,658 | 4,515 | 2,321 | 554,595 | 17,977 | 2.0 |
| St. Bernard | 517,120 | 220,915 | 275,499 | - | 11,838 | 3,065 | 609 | 291,011 | 5,194 | 1.0 |
| St. Mary | 453,760 | 87,147 | 172,308 | 143,000 | 107,276 | 5,440 | 3,549 | 431,573 | -64,960 | -14.3 |
| Terrebonne | 1,144,320 | 314,883 | 621,118 | 122,400 | 73,183 | 5,730 | 5,027 | 827,458 | 1,979 | 0.2 |
| Vermilion | 844,800 | 79,927 | 402,807 | 31,600 | 372,439 | 3,520 | 8,214 | 818,580 | -53,707 | -6.4 |
| Totals | 6,837,760 | 1,686,479 | 3,428,380 | 568,000 | 1,205,277 | 93,005 | 64,520 | 5,359,182 | | |
| % of land in study area by type | | | 63% | 10.6% | 22% | 1.7% | 1.2% | 100% | | |

*Note 1/: Total area less water area = land area. Land area less the aggregated areas of marshland, forest land, agricultural land, urban land and transportation land = unaccounted area. The result may be either positive or negative.

Source: State of Louisiana, 1967. A summary of preliminary findings concerning the Louisiana State Plan. La. Department of Public Works, Baton Rouge.

Table G-3

## Approved Interim Dumping Sites - EPA Region VI

| Location | Size (Square miles) | Depth (Feet) | Primary Use |
|---|---|---|---|
| Calcasieu Pass, Area A<br>29°45', 93°21' | 1.00 | 6+ | Dredged materials |
| Calcasieu Pass, Area B<br>29°45', 93°20' | 1.00 | 6+ | Do. |
| Calcasieu Pass, Area C<br>29°42', 93°21' | 5.00 | 18+ | Do. |
| Calcasieu Pass, Area D<br>29°35', 93°17' | 5.00 | 18+ | Do. |
| Southwest Pass<br>28°52', 89°31' | 2.00 | 45+ | Do. |
| Waste Disposal Area<br>27°44', 94°44', 27°28', 94°28' | 16 mi. by 16 mi. | 2,400 | Chemical wastes |
| Waste Disposal Area<br>28°0', 28°20', 89°15', 89°35' | 20 mil by 20 mi. | 2,400+ | Do. |
| Off Sabine Pass, Tex., Area A<br>29°37', 93°50' | Approx. 5 | 24 | Dredged materials |

continued

Table G-3 (continued)

Approved Interim Dumping Sites - EPA Region VI

| Location | Size (Square miles) | Depth (Feet) | Primary Use |
|---|---|---|---|
| Off Sabine Pass, Tex., Area B<br>29°37', 93°48' | Approx. 3 | 30 | Do. |
| Off Sabine Pass, Tex., Area C<br>29°40', 93°51' | Approx. 4 | 6 | Do. |
| Off Galveston, Tex., Area A<br>29°19', 94°40' | Approx. 2.5 | 36 | Do. |
| Off Galveston, Tex., Area B<br>29°20', 94°39' | Approx. 2.5 | 30 | Do. |
| Off Galveston, Tex., Area C<br>29°17', 94°40' | Approx. 7 | 36 | Do. |
| Off Galveston, Tex., Area D<br>29°22', 94°43' | Approx. 8 | 12 | Do. |

Source: Federal Register, Vol. 38, No. 94, Wednesday, May 16, 1973 and possible hazards of unexploded munitions are discussed below.

The Navy has conducted no munitions dumping in water less than 914 meters in depth since 1945. Additional information received from the Office of the Oceanographer of the Navy are located off the Atlantic and Pacific coasts and no sites are utilized in the Gulf of Mexico.

The Air Force owned and leased approximately 20,235 hectares on Matagorda Island which were used for a variety of military purposes. All of this property has been determined to be in excess of the requirements of the DOD. Disposal of this property has been cleared with the Congressional Armed Services Committees and a Report of Excess has been issued by GSA. All military uses of this property ceased as of June 30, 1975. Action is currently underway to clear the property of unexploded ordnance residue (U.S. Department of Defense, 1975).

The excess portion of Matagorda Island features prime recreational and wildlife resources. Currently proposed use plans focused on the island's major resources are being assessed by GSA in considering reuse and disposal of this former military property.

### Recreation and Allied Resources

The northern Gulf of Mexico coastal zone is one of the major recreational areas of the U.S. particularly in connection with salt-water fishing and beach-oriented activities.

There is considerable diversity in natural landscapes from the semi-arid beaches of south Texas through the marshes of Louisiana. Large numbers of visitors are attracted from outside the region by these natural conditions, as well as the subtropic climate.

In Louisiana, inaccessibility of the coastal marshlands to automobile travelers has limited the development of recreational facilities to a few areas. However, the vast marshlands provide abundant game and fish which attract sport fishermen and hunters.

Public parks and preserves provide opportunities for hunting, fishing, camping, wildlife viewing and photography. Commercial recreational facilities are also very important as well, and include ornamental gardens, marinas and a variety of resorts and services.

The long and colorful history of the Gulf South has provided a rich legacy in architectural forms, historic sites and historic districts. The prehistoric record of archaeological remains in this area is also large and continually expanding through discovery and research.

#### SPORT FISHING

Limited access to fishing areas has precluded full utilization of the sport fishery resources but man-days effort and pounds of catch are impressive. A salt-water angling survey conducted by the National Marine Fisheries Service in 1970 provides the most recent comprehensive sport fishing statistics for the Gulf of Mexico (Deuel, 1973). Visual No. 5 for each of the western, central and eastern Gulf areas displays coastal zone and offshore fisheries. Also of interest in this connection will be Visual No. 4 showing undersea features.

Table G-4 illustrates the number of salt-water anglers and their catch in the western Gulf of Mexico and its relationship to the total United States catch for 1970. Table G-5 illustrates the salt-water fishermen and their catch for the western Gulf of Mexico for 1970.

Detailed information on sport fishing activity, catch and value is not uniformly available for the Gulf of Mexico, although research is underway which should improve this situation soon. The National Marine Fisheries Service has established two sport fishing laboratories in the Gulf area and has undertaken with their port sampling of commercial products the gathering of sport fishing data.

Party boat fishing is characterized by the use of a large boat in the range of 17 to 20 meters carrying a large number of people. Bottom fishing consumes the majority of fishing time, although less often drift fishing and trolling methods are used. Party boats usually charge a set fee per person (per ''head'') and may require a certain minimum number of passengers aboard before they make a trip.

Charter boat fishing is characterized by the use of a smaller boat, about 10 to 14 meters in length, carrying up to 6 or 8 persons. Trolling is the primary method used.

It is estimated that approximately 80% of all fishing activity occurs within 12 miles (20 km) of shore (U.S. Dept. of Commerce, 1973b). A further rationale for the location of this 12 mile (20 km) line was the consideration of the maximum distance a party or charter boat can travel and

Table G-4 Estimated Number of Salt-Water Anglers & Their Catches in the West Gulf Coast of Mexico & Relationship to the Total U. S. Catch for 1970.

|  | No. of Anglers | % of U.S. Total | No. of Fish Caught | % of U.S. Total | Weight of Fish Caught | % of U.S. Total |
|---|---|---|---|---|---|---|
|  | (000) |  | (000) |  | (000 lbs) |  |
| West Gulf of Mexico (Miss. River to Texas) | 872 | 9 | 97,708 | 12 | 151,608 | 10 |
| Total U.S. | 9,392 |  | 817,317 |  | 1,576,823 |  |

Source: Dept. of Commerce; National Marine Fisheries Service
Fisheries of the United States, 1974

Table G-5 Salt-Water Fishermen and Their Catches[1/] by Principal Area and Method of Fishing - 1970

|  | Principal area of Fishing |  | Principal methods of fishing |  |  |  |
|---|---|---|---|---|---|---|
| Region | Ocean | Sounds, rivers, and bays | Private or rented boats | Party or chartered boats | Bridge, pier, or jetty | Beach or bank |
|  | - - - - - - - | - - - - - - - - Thousands | - - - - - - - | - - - - - - - | - - - - - - - | - - - - - - - |
| est Gulf of Mexico: |  |  |  |  |  |  |
| Number of fishermen... | 341 | 477 | 284 | 101 | 288 | 198 |
| Number of fish caught. | 47,173 | 50,535 | 56,684 | 4,425 | 23,236 | 13,363 |
| Total weight. lbs. | 64,800 | 86,808 | 85,505 | 8,579 | 33,024 | 24,200 |

1/ The number of fish caught and the weight of fish caught in the two principal areas of fishing are equal to the total catch for a region, and the number and weight caught by the four methods of fishing are equal to the total catch for a region. However, the number of anglers is not additive as some anglers fished in both areas and by more than one method for certain species groups in a particular region.

Source: Deuel, 1973

return to shore in one day and allow adequate time for fishing in place of anchor.

Louisiana: Sport fishing in Louisiana is a very popular form of recreation. Coastal marshlands with few roads reaching the shoreline has limited fishing access and precluded full utilization of the salt-water fishery resources. Nevertheless, man-days of fishing effort and pounds of catch are impressive. The data used here to portray the intensity of use of Louisiana's sport fishing resource is based on an unpublished report of the results of a telephone survey of 2,270 Louisiana households by the U.S. Fish and Wildlife Service. The study area was divided into nine hydrologic sub-basins as described in Table G-6 and portrayed in Figure G-5. Data is for the 1968 season.

Table G-7 gives man-days and pounds of catch by sub-basin and type of fishing activity. Included are both freshwater and saltwater sport fishing. From this table the success or pounds per man-day effort can be derived. In order of yield, Sub-basin III ranks first with II, VII, I, IV, and VI in descending order. The average for all sub-basins is 4 kg per man-day of fishing effort.

As indicated on Table G-7, saltwater finfishing activities are most concentrated in Sub-basin I and IV. Some of the more popular saltwater sport fish are croaker, red drum, sea trout, flounder, tarpon, snappers and groupers.

Freshwater finfishing activity is concentrated in Sub-basin IV which corresponds to the Atchafalaya River basin. Popular freshwater sport fish include largemouth bass, bluegill, redear, crappie and catfish.

Surf-fishing is popular along the barrier islands of coastal Louisiana, however, most of these islands are accessible only by boat. Sport fishing around offshore oil and gas rigs is also popular. Therefore, the large number of man-days spent in sport fishing indicates a corresponding high level of boating activity. It can be assumed that the highest levels of recreational boating related to sport fishing will be found in Sub-basins I and IV where the most sport fishing activity is concentrated currently. In September, 1970, there were 101,084 registered boats over twelve parishes of Louisiana (Jones and Rile, 1972). This figure includes commercial vessels, but the greatest portion are private recreational boats.

Texas:. The Texas coastal zone, with its immense expanse of shallow bays and beaches accessible to the average man, furnishes an excellent region for the sport fisherman to pursue his avocation. Based upon data generated between 1968 and 1970 the Texas Parks and Wildlife Comprehensive Planning Board ranks fishing as the number one recreational activity in the coastal region of Texas in terms of activity days of participation.

Fishing, with a total of 12,051,800 activity days recorded, was followed by swimming (4,437,100), boating (3,350,000), camping (3,302,900) and picnicking (2,294,700) (Texas Parks & Wildlife Dept., 1974). Table G-8 shows saltwater based activities occurring in the same region but excluding those occurring within urban limits. Fishing again stands out with nearly 6.5 million activity days.

A study of onshore-offshore recreational fisheries conducted through the National Marine Fisheries Serice (1976) for an area extending seaward from the Gulf shoreline between Port Isabel and Port Aransas identified kingfishes, bluefish, seatrout, croaker, pinfish and catfish as the major species caught by pier, boat and jetty fishermen. Red snapper, king mackerel and little tunny were principal species harvested by headboat and inboard motorboat fishermen whereas spanish mackerel and crevalle jack joined the king mackerel as the fishes most often caught from outboard motorboats. Nearly 3.5 million anglers participated in saltwater fishing in the study area during the six month survey period (Table G-9). Another section of this NMFS study (Table G-9.1) gives an indication of the relative abundance and catchability of billfishes sought offshore by fishermen embarking in the vicinity of Port Aransas. The results showed sailfish were most abundant in 1975, whereas blue and white marlin were most abundant in 1974.

Personnel from the Texas Parks and Wildlife Department (1976) recently completed a creel survey of anglers in the Galveston, San Antonio and Aransas bays and upper Laguna Madre areas fishing from boats, banks and piers. This study resulted in an estimate of the species and total catch by recreational fishermen. During the one year period (Sept. 1974-Aug. 1975) sport anglers in the four bay systems harvested over five million fish weighing 218,952 kg. This catch resulted from an estimated 1,633,600 fishing trips with boat fishermen accounting for more than 80% of the catch. Spotted seatrout showed up in almost 50% of sport angler's creels with red and black drum, southern flounder, sheepshead, and gafftopsail

Table G-6 Hydrologic Sub-basins of the Louisiana Coast

| Sub-basin | Area |
|---|---|
| I | The area between Pear River and Bayou Terre aux Boeuf including Lake Maurepas and Lake Pontchartrain. |
| II | The area between Bayou Terre aux Boeuf to the Mississippi River. |
| III | The active Mississippi River Delta south of Bayou Baptiste Coullette and Red Pass. |
| IV | The area between the Mississippi and Bayou Lafourche. |
| V | The area between Bayou Lafourche and the Atchafalaya River. |
| VI | The area between the Atchafalaya River and Bayou Sale. |
| VII | The area between Bayou Sale and along the drainage basin line in the vicinity of Freshwater Bayou and northward to Abbeville and Lafayette. |
| VIII | The area between Freshwater Bayou and the eastern drainage basin for the Calcasieu. This line approximates the line formed by State Highway 27 and north to Iowa, Louisiana. |
| IX | The area of the Calcasieu and Sabine drainage basins. |

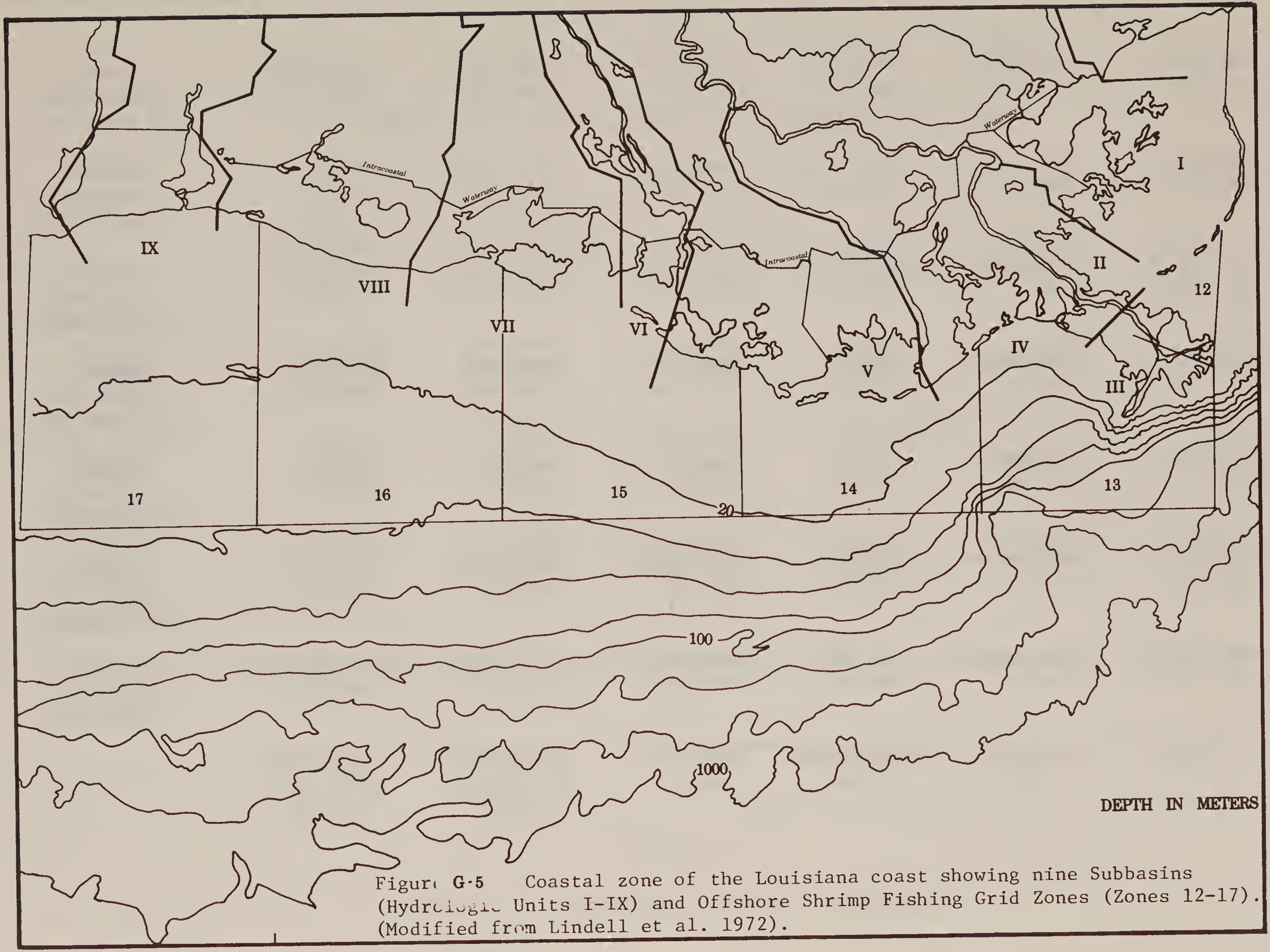


Figure G-5 Coastal zone of the Louisiana coast showing nine Subbasins (Hydrologic Units I-IX) and Offshore Shrimp Fishing Grid Zones (Zones 12-17). (Modified from Lindell et al. 1972).

## Table G-7 1968 Sport Fishing - Louisiana

ACTIVITY

| | SPORT FINFISHING SALTWATER | SPORT FINFISHING FRESHWATER | SPORT CRABBING | SPORT CRAYFISHING | SPORT SHRIMPING | TOTALS |
|---|---|---|---|---|---|---|
| SUB-BASIN I | | | | | | |
| MAN-DAYS | 1,730,000 | 768,000 | 172,000 | 21,000 | 60,000 | 3,751,000 |
| POUNDS | 10,380,000 | 1,536,000 | 15,236,000 | 105,000 | 3,000,000 | 30,257,000 |
| SUB-BASIN II | | | | | | |
| MAN-DAYS | 101,000 | 26,000 | 27,000 | 9,000 | 18,000 | 181,000 |
| POUNDS | 606,000 | 52,000 | 351,000 | 45,000 | 900,000 | 1,954,000 |
| SUB-BASIN III | | | | | | |
| MAN-DAYS | 39,000 | 18,000 | 3,000 | *----- | 18,000 | 78,000 |
| POUNDS | 234,000 | 45,000 | 39,000 | *----- | 900,000 | 1,218,000 |
| SUB-BASIN IV | | | | | | |
| MAN-DAYS | 1,063,000 | 490,000 | 497,000 | 50,000 | 98,000 | 2,198,000 |
| POUNDS | 6,378,000 | 980,000 | 6,461,000 | 250,000 | 4,900,000 | 18,969,000 |
| SUB-BASIN V | | | | | | |
| MAN-DAYS | 570,000 | 391,000 | 115,000 | 24,000 | 63,000 | 1,163,000 |
| POUNDS | 3,420,000 | 782,000 | 1,495,000 | 120,000 | 3,150,000 | 8,967,000 |
| SUB-BASIN VI | | | | | | |
| MAN-DAYS | 63,000 | 1,653,000 | 58,000 | 307,000 | 4,000 | 2,085,000 |
| POUNDS | 378,000 | 3,306,000 | 754,000 | 1,535,000 | 200,000 | 6,173,000 |
| SUB-BASIN VII | | | | | | |
| MAN-DAYS | 185,000 | 192,000 | 61,000 | 31,000 | 49,000 | 518,000 |
| POUNDS | 1,110,000 | 384,000 | 793,000 | 155,000 | 2,450,000 | 4,892,000 |

* NO HABITAT AVAILABLE

Table G-7 (continued)  1968 Sport Fishing - Louisiana

|  | ACTIVITY |  |  |  |  |  |
|---|---|---|---|---|---|---|
|  | SPORT FINFISHING SALTWATER | SPORT FINFISHING FRESHWATER | SPORT CRABBING | SPORT CRAYFISHING | SPORT SHRIMPING | TOTAL |
| SUB-BASIN VIII |  |  |  |  |  |  |
| MAN-DAYS | 72,000 | 487,000 | 56,000 | 74,000 | 22,000 | 711,000 |
| POUNDS | 432,000 | 974,000 | 728,000 | 370,000 | 1,100,000 | 3,604,000 |
| SUB-BASIN IX |  |  |  |  |  |  |
| MAN-DAYS | 222,000 | 229,000 | 261,000 | 20,000 | 41,000 | 773,000 |
| POUNDS | 1,332,000 | 458,000 | 3,393,000 | 100,000 | 2,050,000 | 7,333,000 |
| TOTALS |  |  |  |  |  |  |
| MAN-DAYS | 4,045,000 | 4,254,000 | 2,250,000 | 536,000 | 373,000 | 11,458,000 |
| POUNDS | 24,270,000 | 8,517,000 | 29,250,000 | 2,680,000 | 18,650,000 | 83,367,000 |

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Source: Data from unpublished report by Bureau of Sport Fisheries and Wildlife, 1968.

Table G-8 Total Participation in Saltwater Activities Occurring In Rural Areas Within Texas Gulf Coast Regions (Activity Days)

| Activity | REGION<br>27 | <br>25 | <br>28 | <br>24 | <br>33 | <br>34 | Total |
|---|---|---|---|---|---|---|---|
| Saltwater Boating | 125,258 | 8,914 | 640,644 | 26,480 | 465,408 | 95,821 | 1,362,525 |
| Saltwater Fishing | 220,654 | 296,427 | 2,770,958 | 126,169 | 2,518,885 | 565,357 | 6,498,450 |
| Saltwater Skiing | -0- | 1,740 | 97,921 | 11,538 | 33,592 | 8,048 | 152,839 |
| Surfing | -0- | 3,031 | 206,353 | -0- | 89,053 | 40,184 | 338,621 |
| TOTAL | 345,912 | 310,112 | 3,715,876 | 164,187 | 3,106,938 | 709,410 | 8,352,435 |

Source: Texas Household Demand Survey, 1968, Texas Parks and Wildlife Department, Comprehensive Planning Branch

Table G-9. Estimates of mean daily efforts and total effort by section, fishing platform, and time of week in the study area, 28 April-9 November, 1975.

| Section and Fishing Platform | Weekday Mean Daily Effort | Weekday Total Effort | Weekend-day Mean Daily Effort | Weekend-day Total Effort | Total Effort Weekday and Weekend-day | Percent of Total |
|---|---|---|---|---|---|---|
| | ----------------- | Man-days of fishing | -------------------- | | | |
| Mustang Island | | | | | | |
| Outboard | 45.46 | 6,091 | 102.59 | 6,361 | 12,452 | 3.61 |
| Inboard | 78.50 | 10,519 | 243.16 | 15,076 | 25,595 | 7.43 |
| Headboat | 184.86 | 24,771 | 216.81 | 13,442 | 34,213 | 11.09 |
| Jetty | 96.37 | 12,913 | 213.11 | 13,213 | 26,126 | 7.58 |
| Pier | 178.43 1/ | 47,819 2/ | 289.23 1/ | 35,864 2/ | 83,683 | 24.29 |
| Beach | 185.67 | 24,880 | 387.26 | 24,010 | 48,890 | 14.19 |
| Upper Padre | | | | | | |
| Beach | 55.69 | 7,462 | 332.75 | 20,630 | 28,092 | 8.16 |
| Mid Padre | | | | | | |
| Beach | 12.76 | 1,710 | 72.36 | 4,486 | 6,196 | 1.80 |
| Lower Padre | | | | | | |
| Outboard | 19.81 | 2,655 | 52.52 | 3,256 | 5,911 | 1.72 |
| Inboard | 35.99 | 4,823 | 101.67 | 6,303 | 11,126 | 3.23 |
| Headboat | 26.72 | 3,580 | 20.44 | 1,267 | 4,847 | 1.41 |
| Jetty | 117.08 | 15,689 | 216.31 | 13,411 | 29,100 | 8.45 |
| Pier | 16.11 | 2,159 | 16.21 | 999 | 3,158 | 0.92 |
| Beach | 81.02 | 10,857 | 164.66 | 10,209 | 21,066 | 6.12 |
| TOTAL | | 175,928 | | 168,527 | | |
| GRAND TOTAL | | | | | 344,455 | 100.00 |

1/ Per pier
2/ Both piers

Source: U.S. Dept. of Commerce, 1976. NOAA Final Report - Environmental Studies of the South Texas Outer Continental Shelf, 1975. Volume I, p. 116.

Table G-9.1 - Relative Abundance of billfishes off Port Aransas.

| | No. of hours trolled | No. of fish raised | No. of fish raised per hr. of trolling | Hours trolled to raise 1 fish |
|---|---|---|---|---|
| 1972 | 1,482.4 | | | |
| Blue Marlin | | 73 | .049 | 20.4 |
| White Marlin | | 30 | .020 | 50.0 |
| Sailfish | | 133 | .090 | 11.1 |
| Unidentified Billfish | | 1 | .001 | 1,000.0 |
| All Billfish | | 237 | .160 | 6.3 |
| 1973 | 810.9 | | | |
| Blue Marlin | | 35 | .043 | 23.3 |
| White Marlin | | 8 | .010 | 100.0 |
| Sailfish | | 47 | .058 | 17.2 |
| Unidentified Billfish | | 2 | .002 | 500.0 |
| All Billfish | | 92 | .113 | 8.8 |
| 1974 | 1,298.3 | | | |
| Blue Marlin | | 107 | .082 | 12.2 |
| White Marlin | | 34 | .026 | 38.5 |
| Sailfish | | 182 | .140 | 7.1 |
| Unidentified Billfish | | 11 | .008 | 125.0 |
| All Billfish | | 334 | .257 | 3.9 |
| 1975 | 2,389.7 | | | |
| Blue Marlin | | 90 | .038 | 26.3 |
| White Marlin | | 27 | .011 | 90.9 |
| Sailfish | | 620 | .259 | 3.9 |
| Unidentified Billfish | | 1 | .001 | 2,500.0 |
| All Billfish | | 738 | .309 | 3.2 |

Source: U.S. Dept. of Commerce, 1976. NOAA Final Report - Environmental Studies of the South Texas Outer Continental Shelf, 1975. Volume I, p. 141.

catfish representing other major harvest species in the Texas coastal embayments surveyed. Based on existing data from the National Marine Fisheries Service 1970 Saltwater Angling Survey (Deuel, 1973) and an unpublished report from the U.S. Fish and Wildlife Service, as well as data from the Texas Parks and Wildlife Department, it was possible to extrapolate and arrive at a gross estimate of the total saltwater sport fish catch as well as an average catch per activity day. It must be stressed that the data available from the estimates which were made, represent different years, different research procedures and different geographic areas, leaving a large margin for error. Even though the margin for error is great, the estimates are felt to be within an acceptable range of probability and represent the best data available.

According to the F&WS report, the total catch for Louisiana was estimated at 11 million kg, of which five million kg represented the catch east of the Mississippi River, thus leaving an estimated catch for Louisiana west of the Mississippi River of six million kg. The 1970 Angling Survey estimated the total saltwater sport fish catch in from this total, the new catch for Texas amounted to 63 million kg. According to the Texas Parks and Wildlife Department's 1968 Household Demand Survey, a total of 6,498,450 activity days were expended in saltwater sport fishing. Using these data, the average catch per activity day was calculated to be 10 kg for Texas. By combining the F&WS data for Louisiana (man days activity in saltwater sport fishing) and the data for Texas, an average catch per activity day for the western Gulf was calculated at nine kg.

Although the sport fishing effort for Texas seems disproportionately high in comparison with Louisiana, when the factor of accessibility to the coastal areas is considered, the reason for the difference becomes more apparent. Much of the Louisiana coast is inaccessible and, because of the isolation, the sport fishing activity is much less than along the Texas coast, most of which is accessible. Additionally, pier fishing is extremely popular along the Texas coast, a type of fishing limited to a few isolated locations along the Louisiana coast. Although sport fishing is an extremely popular recreational activity in coastal Louisiana, offshore saltwater sport fishing is a pursuit enjoyed by a more affluent group because ownership of a boat is almost a necessity for the Louisiana saltwater sport fisherman.

Data from the 1970 Angling Survey estimated a total of 872,000 sport fishermen were involved in the saltwater sport fishing effort in the western Gulf. These fishermen caught 69 million kg which would give an average yearly catch of 79 kg per fisherman. The number of fish caught was estimated to be 97,708,000, yielding an average weight per fish of 0.7 kg.

Tables G-10 and G-11, from the 1970 Saltwater Angling Survey (Deuel, 1973) provide detail of the methods of fishing, species of fish caught, their weight and numbers caught in the western Gulf of Mexico.

Big game fishing: Big game fish (also referred to as billfish) are sought in deep water and at considerable distance from shore.

Based on three years of data collection, Luis R. Rivas of the National Marine Fisheries Service made the following comments about the billfish sport fishery of the northern Gulf of Mexico.

During the season (April through October) the fishing effort expended on billfishing amounts to an annual average of 11,756 hours of trolling equivalent to 1,680 boat days. It takes, on the average, 18 fishing days to boat a blue marlin, seven to boat a white, and six to boat a sailfish. Therefore, in 18 days of trolling, it is possible to boat one blue, two whites, and three sails for a total of six billfish, or an average of one fish per three days of trolling. On the average, 657 billfishes weighing a total of 25,303 kg are caught every year. An average of 103 blue marlin weighing a total of 12,988 kg are caught by anglers every year. On the average, 252 white marlin weighing a total of 6,205 kg and 302 sailfish weighing a total of 6,027 kg are caught every year.

In the northern Gulf, the catch-per-unit-of-effort by the sport fishery, for all three species of billfishes combined, was 0.063 fish per hour of trolling in 1971, 0.041 in 1972, and 0.036 in 1973.

Trolling for billfishes is conducted above the continental shelf from about 55 m outward and also above the continental slope at depths of up to 914 meters. Distance from shore varies from as little as 20 km, off the mouth of the Mississippi River, to 97 km or more off the Clearwater-St. Petersburg area of Florida. The most important billfishing ports in the Gulf, from west to east, are Port Isabel, Port Aransas, Rockport and Port O'Connor in Texas.

Table G-10 Number of Fish Caught by Saltwater Anglers in 1970 in the Western Gulf of Mexico by Species and by Principal Area and Method of Fishing. (Thousands)

| | Principal Area of Fishing | | Principal Method of Fishing | | | |
|---|---|---|---|---|---|---|
| Species | Ocean | Sounds Rivers & Bays | Private or Rented Boats | Party or Charter Boats | Bridge Piers or Jetty | Beach or Bank |
| Catfish | 3,083 | 12,307 | 4,512 | 725 | 7,661 | 2,492 |
| Croakers | 5,476 | 8,417 | 3,384 | 892 | 6,237 | 3,380 |
| Drum, Black | 724 | 4,363 | 4,435 | 16 | 457 | 179 |
| Drum, Red | 2,366 | 3,545 | 4,131 | 47 | 418 | 1,315 |
| Flounders, Summer | 984 | 1,192 | 1,714 | 124 | 185 | 153 |
| Grunts | 11,805 | 20 | 11,555 | - | 270 | - |
| Kingfish | 2,712 | 531 | 541 | 163 | 2,279 | 260 |
| Porgies | 470 | 1,498 | 1,107 | 163 | 225 | 473 |
| Sea Trout, Sand | 5,282 | 2,907 | 5,645 | 450 | 1,515 | 579 |
| Sea Trout, Spotted | 11,185 | 13,113 | 17,615 | 985 | 2,599 | 3,099 |
| Snappers | 1,047 | 168 | 537 | 390 | 288 | - |

Source: Deuel. 1973.

TABLE G-11

SALTWATER SPORTFISHING EFFORT IN THE WESTERN GULF OF MEXICO* BY SPECIES GROUP, NUMBER OF FISH CAUGHT, NUMBER OF ANGLERS, AND ESTIMATED WEIGHT OF CATCH.

| Species Group | Number of Fish Caught (000) | Number of Anglers (000) | Estimated Weights (000 lbs) |
|---|---|---|---|
| Basses | 12 | 4 | 24 |
| Bluefish | 477 | 24 | 1,308 |
| Bonitos | 12 | 6 | 37 |
| Catfishes | 15,390 | 279 | 17,800 |
| Cobia | 85 | 3 | 43 |
| Croakers | 13,893 | 403 | 14,743 |
| Drum, Black | 5,087 | 185 | 13,004 |
| Drum, Red | 5,911 | 302 | 25,520 |
| Eel, American | 17 | 17 | 19 |
| Flounders, Summer | 2,176 | 211 | 2,985 |
| Groupers | 438 | 40 | 922 |
| Grunts | 11,825 | 32 | 4,316 |
| Jacks | 145 | 40 | 1,223 |
| Kingfishes | 3,243 | 90 | 3,107 |
| Mackerels, King | 259 | 39 | 2,978 |
| Mackerels, Spanish | 479 | 31 | 608 |
| Mullets | 257 | 16 | 95 |
| Perches | 688 | 58 | 584 |
| Pompanos | 135 | 45 | 179 |
| Porgies | 1,968 | 164 | 5,675 |
| Puffers | 25 | 12 | 8 |
| Sea Robins | 4 | 4 | 1 |
| Sea Trout, Sand | 8,189 | 200 | 9,345 |
| Sea Trout, Spotted | 24,298 | 406 | 40,487 |
| Sharks | 68 | 12 | 1,167 |
| Sharks, Dogfish | 58 | 25 | 54 |
| Skates and Rays | 271 | 29 | 1,603 |
| Snappers | 1,215 | 49 | 2,554 |
| Snappers, Red | 119 | 12 | 278 |
| Spadefish, Atlantic | 190 | 30 | 283 |
| Miscellaneous | 774 | 45 | 658 |
| Total | 97,708 | ** | 151,608 |

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* The Western Gulf includes the area between the mouth of the Mississippi River and the Mexican border.

** The number of anglers is not additive because of duplication of anglers among species groups.

Source: Deuel, 1973.

The billfish sport fishery was practically nonexistent in the Gulf until about 20 years ago. Pioneered by the New Orleans Big Game Fishing Club, it has grown tremendously since its inception and it still continues to grow.

Artificial reefs: In recent years, the establishment of artificial reefs has become popular in the Gulf of Mexico. These artificial reefs made of old car bodies, tires, concrete pipes, ships, rubble and numerous other materials provide additional surface area of hard substrate on which numerous types of algae and invertebrate species may grow. These organisms are available as food for foraging species which in turn, attract predatory fishes. In addition to the expanded food chain and tropic food level potentials, the artificial reefs serve as refuge, protection and orientation sites. These new sites by attracting and concentrating fish species improve fishing success. However, the population size of fish species are not necessarily increased.

The Texas Coastal and Marine Council has acquired 12 Liberty Ships to use as offshore artificial reefs. Four locations have been selected, each of which will be a site for establishing a reef by sinking of three stripped-down Liberty Ships. The reefs, will be from about 20 to 55 km from shore to make them accessible to sport fishermen and divers. However, they will be in water at least 24 meters deep in order to allow 15 meters of clearance above the ships which, when stripped, will be about 9 meters high. Three ships have been placed in Block 1070, South Padre Island near Port Mansfield and one ship has been sunk in Block 802, Mustang Island. Two additional ships are ready for sinking and others are in various stages of preparation.

### RECREATIONAL BOATING

A 1973 National Marine Fisheries Service study provides a general overview of recreational boating in the U.S. and its subdivisions, including the states bordering the Gulf of Mexico. As of October 1973 there were 8,008,000 privately owned recreational fishing boats in the U.S. (Ridley, 1975) and some 1,010,000 of these boats were used in saltwater recreational fishing activities. It was further estimated that commercial recreation fishing boats in the U.S. numbered 2,496. Table G-12 provides more detail data for the Gulf of Mexico Region. In this region 349,000 private recreation boats were used in saltwater. Most of these boats were under 26 feet (8 meters) in length. There were also 473 commercial recreational fishing boats, predominantly in the 40′ - 65′ (12-20 meters) length class.

Recreational boating activity is also high in the central Gulf coast area as indicated by saltwater fishing activity.

As previously mentioned, in 1970 there were 101,084 boats of all types over 12 feet (3.7 meters) in length registered in coastal parishes of Louisiana.

In Texas the use of boats for fishing and for a variety of other recreational activities is increasing rapidly. Data compiled by the Texas Parks and Wildlife Department between November 1970 and November 1973 show that the total boat registration in the 17 Texas Coastal Counties increased 60.6 percent (from 73,393 to 121,124). The top ten coastal counties accounted for approximately 28 percent of all boats registered in Texas during this period.

Population and public access to water seem to be the major factors bearing on boat numbers. Harris County has the largest population and by far the largest number of boats registered in the coastal zone. In general, the counties with high boat registration have access to a large amount of bay and ocean frontage. However, Harris, Orange and San Patricio Counties have no open ocean frontage and relatively little bay frontage, but they do have water access to the ocean and a great deal of fresh water located in or near their boundaries.

The importance of these boats for outdoor recreation is indicated by over 96 percent of those registered in this area in 1973 being classified as "pleasure use" craft. Table G-13 illustrates the top ten coastal counties in boat registrations for Texas.

### HUNTING

Hunting is one of the higher ranking outdoor recreational activities in the Central Gulf area. Important mammals include deer, squirrels, rabbits and occasionally raccoons. Upland birds include quail, dove, turkey and a variety of water fowl are taken in the marshes and coastal water areas.

Hunting effort for coastal Louisiana by species and sub-basin is portrayed in Table G-14. For the entire zone, rabbits rank first and ducks a close second. A more detailed discussion of Louisiana

Table G-12 Recreational Boating Activity in States Bordering the Gulf of Mexico
November, 1972 - October, 1973

| | Less than 16' | 16-26' | Greater than 26' | Total |
|---|---|---|---|---|
| Estimated No. of Private Recreational Boats | 988,000 | 389,000 | 31,000 | 1,408,000 |
| No. of Private Recreational Boats that Fished in Saltwater | 190,000 | 141,000 | 18,000 | 349,000 |
| | Less than 40' | 40-65' | Greater than 65' | All Classes |
| Estimated No. of Commercial Recreational Fishing Boats | 85 | 310 | 42 | 473 |

| Major Species of Fish Sought By: | Open Ocean | Rivers, Sound, and Bays |
|---|---|---|
| Private Recreational Boaters | Groupers, Red Snappers, Trouts, Snook | Spotted Sea Trout, Red Drum, Snappers |
| Fishermen on Commercial Recreation Boats | Red Snappers, Snappers, Groupers, King Mackerel, Kingfishes | Red, Snapper, Spotted Sea Trout, Sand Sea Trout |

Source: Ridgely, 1975.

## Table G-13

## Top Ten Texas Coastal Counties In Boat Registration 1970-1973

| 1970 Rank | 1970 County | 1970 No. of Boats Registered | 1973 County | 1973 No. of Boats Registered |
|---|---|---|---|---|
| 1 | Harris | 39,819 | Harris | 66,436 |
| 2 | Jefferson | 7,904 | Jefferson | 14,809 |
| 3 | Galveston | 4,935 | Galveston | 7,482 |
| 4 | Nueces | 4,908 | Nueces | 7,158 |
| 5 | Brazoria | 3,699 | Orange | 6,947 |
| 6 | Orange | 3,604 | Brazoria | 6,530 |
| 7 | Cameron | 1,538 | San Patricio | 2,389 |
| 8 | San Patricio | 1,524 | Cameron | 2,261 |
| 9 | Calhoun | 1,191 | Matagorda | 1,559 |
| 10 | Matagorda | 1,075 | Calhoun | 1,476 |
| | TOTAL | 70,197 | TOTAL | 117,047 |

Source: Boat Registration Division, Revenue Branch, Texas Parks and Wildlife Departments, 1974.

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## Table G-14

## Hunting Effort in Coastal Louisiana
(Data in man-days x 100 during 1968-69 season)

| Sub-Basin | Squirrels | Rabbits | Quail & Dove | Other Small Game | Deer & Turkey | Duck | Geese | Other Marsh Birds |
|---|---|---|---|---|---|---|---|---|
| I | 29.4 | 68.5 | 18.5 | 2.2 | 17.6 | 66.0 | 6.6 | 1.9 |
| II | 0 | 0 | 0 | 0 | 1.2 | 3.9 | 0 | 0 |
| III | 0 | 0 | 0 | 0 | 0 | 12.0 | 6.0 | 8.8 |
| IV | 31.2 | 108.0 | 5.6 | 0 | 3.5 | 68.7 | 0 | 16.4 |
| V | 43.0 | 131.6 | 17.5 | 0 | 6.4 | 64.0 | 5.1 | 4.6 |
| VI | 187.2 | 176.9 | 13.9 | 13.5 | 144.0 | 81.7 | 4.6 | 0 |
| VII | 50.3 | 92.4 | 133.1 | 12.6 | 48.7 | 82.9 | 17.8 | 4.7 |
| VIII | 55.3 | 59.4 | 58.0 | 1.3 | 15.4 | 140.4 | 54.8 | 0 |
| IX | 23.4 | 56.1 | 29.2 | 5.2 | 3.6 | 135.4 | 28.7 | 1.5 |
| TOTALS | 419.7 | 693.0 | 276.0 | 34.7 | 240.4 | 655.8 | 123.6 | 37.9 |

Unpublished Fish and Wildlife Service Telephone Survey hunting may be found in Final Environmental Statement, OCS Sale No. 36.

### OUTDOOR RECREATION AREAS

Included under this heading are federal and state wildlife refuges, game management areas, state parks, beaches used for recreation, ornamental garden, and historical and archaeological sites. These are portrayed on Visual No. 1.

A proposal to establish a wilderness area comprising 6ll hectares of Horn and Petit Bois Islands is now under consideration by the National Park Service. Another 1,036 hectares are considered potential for later addition to the wilderness area.

Chalmette National Historical Park was the scene of the Battle of New Orleans in the War of 1812. This 55 hectare park includes the inactive Chalmette National Cemetery and received 230,000 visits in 1975.

Padre Island National Seashore occupies 54,420 hectares of Padre Island extending 129 km along the south Texas shore from Corpus Christi to near the mouth of the Rio Grande. Besides being one of the last natural seashores in the nation, Padre Island is a wintering area for migratory waterfowl. The island offers numerous recreational activities including swimming, camping, surfing, surf fishing, hiking, birdwatching, beachcombing, scuba diving and sunbathing. In 1975, Padre Island National Seashore received 893,000 visits.

National natural landmarks: The National Park Service administers the National Landmarks program. The objective of this program is to assist in the preservation of natural areas which will illustrate the diversity of the country's natural history. Registration of a site as a Natural Landmark does not change its ownership. However, the owner of the site is required to preserve the natural character of the registered site in order to retain its registration as a Natural Landmark.

There are as yet no registered national natural landmarks in Louisiana and none in the coastal zone of Texas.

National wildlife refuges: The U.S. Fish and Wildlife Service of the U.S. Department of the Interior has the responsibility for ensuring the conservation of the country's wild birds, mammals and sport fish. The primary purposes of wildlife refuges are to provide sanctuaries for wildlife and fish by preserving breeding grounds and habitat which may be becoming scarce in other areas due to encroachment on natural habitats by agricultural, industrial and urban development, and to provide opportunities for the scientific study of various species of wildlife and for the management and preservation of their populations. These refuges also provide important opportunities for outdoor recreation, primarily nature study and natural scenery appreciation.

The Louisiana coastal zone contains five national wildlife refuges.

The Delta Breton National Wildlife Refuge consists of Breton and Chandeleur Islands and was established October 1904 and contains 1,824 hectares. Many waterfowl and shore birds frequent the islands, and sea turtles nest on their shores. They may be reached only by water and there are no recreational facilities.

The Delta National Wildlife Refuge is on the east bank of the Mississippi River, 11 km below Venice and is accessible only by boat. The refuge contains 19,749 hectares. Thousands of blue and snow geese and many species of ducks arrive each fall from the northern breeding grounds to winter on the Delta marshes. Deer and fur-bearing animals are found in abundance. Alligators are seen frequently but are not abundant. Sport fishing is permitted.

Lacassine National Wildlife Refuge is located in southwest Louisiana. At this 12,856 hectare waterfowl wintering area one can see the largest concentration of white-fronted geese in the Mississippi Flyway and one of the larger populations of fulvous tree ducks in the United States. Part of the refuge is open to waterfowl hunting. A main attraction is a 6,475 hectare fresh water pool where sport fishing is permitted. Shell Keys National Wildlife Refuges is under the administration of Lacassine Refuge. Established August 1907, Shell Keys Refuge is a 20 hectare colonial bird nesting island offshore in the Gulf of Mexico.

Also in southwest Louisiana is the Sabine National Wildlife Refuge. Established in December 1937, and located in Cameron Parish, the refuge contains 57,809 hectares. It includes three large artificial freshwater impoundments, and is bounded on the west and east by two large brackish lakes, Sabine and Calcasieu. Sabine provides a winter home for thousands of geese and ducks. Flocks of blue and snow geese may be seen feeding in the marshes adjacent to the highway. Sport fishing and waterfowl hunting are permitted. The wildlife trail in Pool 1B affords excellent opportunities for visitors in all seasons.

There are five national wildlife refuges on the Texas Gulf coast. The eastern most refuge, Anahuac, occupies 4,023 hectares on East Bay of Galveston Bay. The primary species for this refuge are: Lesser Canada, snow and blue geese, mottled ducks, masked ducks, canvasbacks and yellow rails. Rare and endangered species are alligators, bald eagles and peregrine falcons and the Red Wolf.

Brazoria National Wildlife Refuge contains 3,857 hectares of coastal marsh and prairies in Brazoria County. Three-fourths of the refuge is less than 1.2 meters in elevation, and spoil bank knolls and windbreak plantings are the only break in the marsh vegetation. The primary species of this refuge are: geese, ducks and muskrats and endangered species include alligators and red wolves. The refuge offers public hunting and fishing in limited areas, sightseeing, birdwatching and nature photography. The refuge office, which also administers the San Bernard National Wildlife Refuge, is located in Angleton, Texas.

San Bernard National Wildlife Refuge, which was established in November of 1968, is Texas' newest wildlife refuge containing 6,038 hectares in Brazoria and Matagorda counties. The primary species for this refuge are: geese, ducks, wading birds, shorebirds and the endangered red wolf.

The Aransas National Wildlife Refuge occupies 22,190 hectares in Calhoun, Aransas and Refugio counties and is the largest on the Texas coast. This refuge is the wintering ground for the rare and endangered whooping crane. Other primary species include: sandhill cranes, roseate spoonbills, egrets, herons, peregrine falcons, geese, ducks, turkeys, shorebirds, deer, peccaries, caracaras, white-tailed hawks, Texas red wolves and alligators.

Texas' second largest wildlife refuge, Laguna Atacosa National Wildlife Refuge, occupies 18,272 hectares in Cameron County. Located 40 km northeast of San Benito, this refuge was established in March of 1946 to serve as a wintering and feeding refuge. Principal species include: geese, ducks, herons, ibises, shorebirds, gulls, terns, doves, cranes, white-tailed hawks and whitetailed kites. The refuge offers a variety of habitat including coastal prairies, salt flats and low wooded ridges. Subtropical forms, such as the ocelot and the aguarundi, occur along with species from the northern latitudes. Tour roads, hiking trails, and blinds are provided for visitors to use in sightseeing, nature study and photography. Camping is permitted in designated areas, and saltwater fishing and boating are allowed in the Intracoastal Canal. A major portion of the Laguna Atascosa National Wildlife Refuge has been recommended for National Landmark recognition.

State wildlife refuges and management areas: Texas and Louisiana maintain wildlife management areas within the coastal zone. Their locations and approximate size can be determined from Visual No. 1.

Although management goals may differ somewhat between the states, these areas serve primarily to maintain habitat and breeding space for wildlife and to provide wildlife-oriented recreation under closely controlled conditions.

The State of Louisiana administers three wildlife refuges in coastal Louisiana.

Rockefeller Wildlife Refuge—33,185 hectares. It is a major wintering ground for blue and snow geese in the Mississippi Flyway. Mammals found here include muskrats, nutria, deer and rabbits. Extensive impoundments have been constructed to control and regulate water levels.

Louisiana State Wildlife Refuge—6,070 hectares. Species include numerous waterfowl, nutria, muskart and raccoon. Marsh Island Wildlife Refuge—31,971 hectares. It is an important wintering area for blue, snow and Canada geese and contains a large concentration of alligators.

The Texas Parks and Wildlife Department administers three state-owned wildlife management areas. They range from 3,401 to 203 hectares in size. The smallest, Las Palomas Wildlife Management, is in extreme southwest Texas and is divided into three separate small units. Sheldon and J. D. Murphree are the other two management areas.

Private wildlife refuges: The National Audubon Society manages the 10,587 hectare Paul J. Rainey Wildlife Refuge on the Louisiana coast as well as several tracts in the Texas coastal zone. Some of these are located near state or national wildlife refuges and serve to extend the sanctuary provided by these refuges.

Table G-15 lists the state wildlife management areas and preserves.

Table G-16 identifies the Audubon sanctuaries in Texas. They are located on Visual No. 1 for the western Gulf.

Table G-15 State Wildlife Management Areas and Preserves

| Name of Area | County Location | Hectares |
|---|---|---|
| Louisiana | | |
| Pearl River | St. Tammany (Parish) | 10,812 |
| St. Tammany | St. Tammany | 526 |
| Biloxi | St. Bernard | 16,019 |
| Bohemia | Plaquemines | 6,475 |
| Pass a Loutre | Plaquemines | 26,710 |
| Wisner | Lafourche | 8,750 |
| Salvador | St. Charles | 11,219 |
| Pointe au Chien | Lafourche | 11,430 |
| Thistlethwaite | St. Landry | 4,492 |
| West Bay | Allen | 22,333 |
| Sabine | Calcasieu | 4,249 |
| Texas | | |
| J. D. Murphee | Jefferson | 3,401 |
| Sheldon | Harris | 1,013 |
| Las Palomas | | |
| Longoria Unit | Cameron | |
| Voshell Unit | Cameron | |

Source: Louisiana State Parks and Recreation Commission, 1974.
Texas Parks and Wildlife Dept., 1974.

Table G-16 National Audubon Society Sanctuaries in Texas

| Name of Area | Hectares |
|---|---|
| Vingt-et-un Islands of Galveston, Turtle and East bays | 16 |
| Matagorda Island on Wynns Ranch across from Aransas National Wildlife Refuge in Mesquite, Ayres and San Antonio bays | 2,315 |
| Green Island and Three Island Tracts in Laguna Madre | 182 |
| Birds Island and North Deer Island in Chocolate and West Bay and the southwest part of Galveston Bay | 40 |
| Lydia Ann Island, portions of Harbor Island and small tracts in Copano, St. Charles, Aransas and Red Fish bays | 304 |
| Tract portions of the second chain of islands in San Antonio Bay | 32 |
| | 2,884 |

Source: Texas Parks and Wildlife Department, 1974.

National and state parks: There is one National Park Service area located in Louisiana, the Chalmette National Historical Park, located on the site of the Battle of New Orleans.

State parks average much smaller in size than the wildlife areas previously discussed and are generally more activity oriented than the national parks. They are numerous and widely distributed along the Texas and Louisiana coast and serve a large number of people within their localities as well as significant numbers of regional and national visitors.

Collectively the state parks constitute a major part of the recreational resources of the region. Their number and diversity makes generalization difficult. Not only do they vary in size, but their activity and resource orientation varies from fishing causeways through intensively developed recreation sites to scientific, cultural and aesthetic themes.

Table G-17 lists the state parks found in Louisiana and Texas. Most of the Louisiana parks are small, encompassing a few acres up to a few hundred acres. Fontainbleau on Lake Pontchartrain's north shore is the largest Louisiana park listed at 1,115 hectares.

Local outdoor recreation facilities: In addition to Federal and State recreation areas, there are numerous city and county parks and recreation areas in the coastal zone. These facilities are generally located in and around the major population centers where the demand is greatest. In addition private and commercial recreation facilities exist in great numbers. The list could include marinas, tennis clubs, amusement parks and many others. Due to their large number, small size, and difficulty in obtaining comparable data for the entire Gulf area a complete mapping of these facilities was not attempted. This should not be construed as detracting from their importance in providing the bulk of day-to-day outdoor recreation opportunities for Gulf coast residents.

Recreation beaches: Wherever they are accessible for recreational use the sandy beaches along the Texas and Louisiana coasts are of major recreational importance. These beaches are also potentially vulnerable to offshore oil spills and to direct visual impact from any near-shore structures or lease generated traffic.

A detailed inventory of the Texas and Louisiana shoreline conditions is provided by the U.S. Army Corps of Engineers National Shore Line Study Regional Reports, 1971.

The three areas in coastal Louisiana which have experienced the most beach-oriented recreational development are Grand Isle, Vermilion Bay, and the southwest Louisiana coastline between Holly Beach and the mouth of the Mermentau River. Although there are many kilometers of beach shoreline, a large portion of it is very narrow, of poor recreational quality, and generally inaccessible.

Grand Isle is Louisiana's principal developed beach comprising about 11 km of Gulf beach ranging from 7 to 122 meters in width. Grand Isle State Park located on two tracts, one on each end of the island provides the public recreational facilities. The most popular activities are swimming and surf fishing.

Cypremort Beach and camping areas are the principal recreational developments along the eastern shore of Vermilion Bay.

In southwest Louisiana there is a fairly consistant Gulf beach shoreline between the mouth of the Mermentau River and the Texas border. Rutherford Beach, an undeveloped state park, is located near the mouth of the Mermentau River. Louisiana Hwy 82 parallels and provides access to the beaches of southwest Louisiana however their inferior quality has failed to sustain old or encourage new beach support developments.

Other outdoor recreation areas of significant value in coastal Louisiana which are being considered as possible additions to the State park system are Isles Dernieres, Little Chenier (in Cameron Parish) and Chenier-au-Tigre (in Vermilion Parish).

The Cheniere region of southwestern Louisiana offers unique outdoor recreation opportunities. However, access by automobile is quite limited in some parts of the region. Little Chenier is an abandoned beach ridge about eight km long and up to 46 meters wide. This ridge and Cheniere-au-Tigre, dominated by moss-covered live oaks offer excellent opportunities for camping, picnicking, and sightseeing from a vantage point which provides a close look at the surrounding marshlands.

The Isles Dernieres is a 32 km long chain of barrier islands in Terrebone Parish. The topography of these islands consists of sandy beaches, low grassy dunes, and sand flats, salt marsh and mangrove swamp. This environment provides a habitat for a wide variety of birds, most importantly herons and egrets. There is no development on the islands other than a large cabin and

# Table G-17 State Parks of Louisiana and Texas

## Louisiana State Parks

| Name | Hectares |
|---|---|
| Fort Macomb | 7 |
| Fort Pike State Monument | 51 |
| Longfellow-Evangeline | 64 |
| Bogue Falaya Wayside Park | 5 |
| Fontainebleau | 1,115 |
| Sam Houston | 432 |
| St. Bernard | 145 |
| Edward Douglas White State Monument | 2 |
| Fairview Riverside | 41 |
| Nibletts Bluff Confederate Memorial | 13 |
| Grand Isle | 57 |
| Cypremort Beach | 75 |
| Rutherford Beach | N/A |

Total Hectares 2,007*

* excluding Rutherford Beach

## Texas State Parks

| Name | Hectares |
|---|---|
| Sea Rim State Scenic Area | 6,495 |
| San Jacinto Battlefield State Historic Park | 181 |
| Varner-Hogg Plantation State Historic Park | 27 |
| Mud Island State Recreation Park (undeveloped) | 435 |
| Goose Island State Recreation Park | 124 |
| Mustang Island State Recreation Park (undeveloped) | 1,445 |
| Brazos Island State Scenic Park | 87 |
| Sabine Pass Battleground State Park (undeveloped) | 23 |
| Galveston Island State Recreation Park (undeveloped) | 777 |
| Bryan Beach State Park (undeveloped) | 224 |
| Port Lavaca Causeway State Recreation Park | 1 |
| Copano Bay Causeway State Park | 2 |
| Lipanitlan State Park | 2 |
| Port Isabel Lighthouse State Historic Site | 1 |

Total Hectares 9,824

| | Hectares | Total Hectares |
|---|---|---|
| Louisiana | 5 | 2,005 |
| Texas | 6 | 9,823 |
| | 11 | 11,828 |

Source: Louisiana State Parks and Recreation Commission, 1974.
Texas Parks and Wildlife Dept., 1974.

docking facility in the Whiskey Island group. There are no roads, trails, or utility services. Oil fields surround the islands but there is no industry activity on the islands. Access is possible only by boat or airplane.

The most popular recreational activity on the Isles Dernieres is sport fishing from the beach or offshore in the surrounding waters. Camping, picnicking, and sightseeing are also done but most often in conjunction with sport fishing. Use of the island for other recreation is limited because of limited access and frequent flooding by storm tide.

Table G-18 gives selected data for Louisiana and Texas.

The Texas and Louisiana shore is approximately 1,200 miles (1,931 km), 700 miles (1,126 km) of which are sand beaches and 500 miles (805 km) non-beach shore, usually marsh or mangrove. Bay and estuarine shoreline is much greater, totaling about 4,400 miles (7,080 km), with a much lower ratio of beach to non-beach shoreline. Public ownership of the total Texas-Louisiana shoreline is about twenty-three percent and approximately eleven percent is used for recreation, public and private.

Sand beaches are identified on Visual No. 1 (Volume 3).

Louisiana has very limited beach area suitable for recreation. The three areas in coastal Louisiana which have experienced the most beach-oriented recreational development are Grand Isle, Vermilion Bay, and the southwest Louisiana coastline between Holly Beach and the mouth of the Mermentau River. Although there are many kilometers of beach shoreline, a large portion of it is very narrow, of poor recreational quality and generally inaccessible.

The Texas coast has 373 miles (600 km) of shoreline facing the Gulf of which 361 miles (581 km) is beach shore. The much more extensive Bay and estuarine shore has very little beach area. An estimated 270 miles (434 km) of Gulf beach are used for public recreation. The mainland shore is paralleled by barrier islands except at Sabine Pass, the Brazos River delta and the entrances to bays and lagoons. These barrier islands range in width from a few hundred meters to five km and are separated from the mainland by shallow coastal lagoons, five to eight km wide. This double shoreline combined with the sub-tropical climate and gentle terrain of the region provide conditions favorable for year-round outdoor recreation. As previously mentioned, the Padre Island National Seashore faces the Gulf with about 129 km of excellent beach from Corpus Christi southward.

The Texas "open beach law" passed by the Texas Legislature in 1959 provides for public access and use of the beaches having open Gulf exposure from the mean low tide to the vegetation line. Not all beaches are physically suitable for recreation use and there remain some legal questions relating to full public utilization of Texas beaches.

Miscellaneous recreation resources: Several additional significant recreational resources are found along the Gulf coast. Louisiana contains ornamental gardens, and scenic roads and rivers have been designated in Louisiana and Texas. Louisiana has just completed a statewide trails development plan indicating a widespread interest in hiking and biking facilities.

There are two major ornamental gardens in Louisiana; north of Vermilion Bay are found the Avery Island Jungle Gardens and Rip Van Winkle Gardens.

### HISTORICAL RESOURCES

The National Register of Historic Places was the major source consulted for historical sites, (Federal Register, 1976). The State Historical Preservation Officers for Texas and Louisiana were contacted to determine if any historical or archaeological sites potentially eligible for the National Register are located in the Gulf OCS area. None are known at the present time within the area to be affected by this sale.

The National Register of historic sites and the number of recorded archaeological sites in each Gulf coastal county are shown on Visual No. 1

The following sites are included in the National Register as of February 10, 1976 but were not availabe in time for inclusion on Visual No. 1.

**TEXAS**

John McCroskey Cabin
East End Historic District
Old Brulay Plantation
Grace Episcopal Church
Mosquito Fleet Berth, Pier 19
Old Galveston Customhouse
Powhatan House
St. Mary's Cathedral
Lucas Gusher Spindle top Oil Field
Pompeiian Villa
Annunciation Church
Kellum-Noble House
Old Houston National Bank
Cleveland Harding, Sewall House

Table G-18 Gulf of Mexico - Selected Shoreline Information

| Location | Physical Characteristics | | | Shore Ownership | | | Shore Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Shore Length | Beach Length | Non-Beach Shore | Federal | Non-Federal Public | Private | Public Recreation | Private Recreation | Non-Recreational Deve. | Undeveloped |
| | (Miles of Shore) | | | | | | | | | |
| A. Gulf Shoreline | | | | | | | | | | |
| Louisiana | 810 | 365 | 445 | 160 | 181.9 | 468 | 7.5 | 2.1 | 7.2 | 793.2 |
| Texas | 373 | 361 | 12 | 96 | 12 | 265 | 270 | 41 | 0 | 62 |
| Sub-Total | 1,183 | 726 | 457 | 256 | 193.9 | 733 | 277.5 | 43.1 | 7.2 | 855.2 |
| B. Bay and Estuary Shore | | | | | | | | | | |
| Louisiana | 1,133 | 470 | 663 | 85.4 | 150 | 897.6 | 10.3 | 26.1 | 39.1 | 1,057.5 |
| Texas | 2,125 | 16 | 2,109 | 292 | 43 | 1,790 | 116 | 119 | 107 | 1,783 |
| Sub-Total | 3,258 | 486 | 2,772 | 377.4 | 193 | 2,687.6 | 126.3 | 145.1 | 146.1 | 2,840.5 |
| Total Shoreline | 4,441 | 1,212 | 3,229 | 633.4 | 386.9 | 2,760.6 | 303.8 | 188.2 | 153.3 | 3,695.7 |

Source: U.S. Dept. of Army, Corps of Engineers, 1971.

**LOUISIANA**
- Confederate Memorial Hall
- Gallier Hall
- LeCarpentier-Beauregard-Keyes House
- St. Louis Cemetery No. II
- St. Louis Cemetery No. I
- Abita Springs Pavilion
- Enterprise Plantation
- St. Louis Plantation
- Alexandre Mouton House
- Old Lafayette City Hall

Source: Federal Register. 1976 Volume 41, No. 28, February 10.

### ARCHAEOLOGICAL RESOURCES

Evidence of human habitation dating back thousands of years can be found throughout Texas and Louisiana. Archaeological sites are reported in all counties and parishes bordering the Texas and Louisiana coastlines. The total number of sites known and recorded in each county is shown on Visual No. 1.

Because of the sensitive nature of the location of archaeological sites, only those major sites which are of general public knowledge or are afforded protection are individually shown on the visuals. There are certain sites on the National Register of Historic Places.

For the sixteen Texas counties adjacent to the Gulf, 1,359 archaeological sites had been recorded by September, 1974. A total of forty-three of these sites had been excavated and an estimated five percent of the total area had been systematically surveyed for archaeological sites. Individual coverage ranged from no systematic survey in Aransas County to approximately 15 percent coverage in Cameron, Jackson and Kleberg Counties (Texas Archaeological Res. Lab., 1974). There are 594 known sites in Louisiana parishes bordering the Gulf.

Additional discussion of archaeological resources can be found in the Department of the Interior's Final Environmental Statements for OCS Sale No. 38, FES 75-37 (central Gulf), Vol. I, pp. 237-241; and OCS Sale No. 37, FES 74-63 (western Gulf), Vol. I, pp. 355-363.

Submerged archaeological sites: There is increasing interest in submerged sites of archaeological value offshore on the continental shelf or in estuaries and embayments. Because man has inhabited the Gulf coast region for thousands of years, there was human occupation in the area at a time when sea level was much lower than it has been within historic times.

Shipwrecks: The waters of the northern Gulf of Mexico contain numerous shipwrecks dating back to the early sixteenth century. Considerable work has been done in the archives of Mexico, Spain and many other countries to identify and locate early casualties in the Gulf of Mexico. More modern losses may be identified by the U.S. Navy, Coast Guard, and insurance company records or other contemporary sources.

A Department of Interior study is nearing completion by Dr. Sherwood Gagliano to determine the zones of highest probability within the northern Gulf of Mexico for the occurrence of historically significant shipwrecks, as well as the potential for submerged human dwelling sites.

Texas is an area of particularly active shipwreck research. Briggs (1971) lists 83 known wrecks along the Texas coast dating from 1552 to 1897. Mr. Carl Clausen has conducted extensive underwater surveys in Matagorda Bay and along Padre Island for the Texas State Antiquities Commission. A number of the anomalies discovered are believed to be early shipwrecks, and one site, designated 41KN10, was excavated in 1972 yielding artifacts of an early Spanish galleon.

These surveys, which are being gradually extended along the coast, by Mr. J. Barton Arnold for the Texas Antiquities Commission, are conducted close to shore and well within state waters.

## Transportation

### GENERAL

The ports and harbors along the Gulf coast from New Orleans to Corpus Christi are shown in Table G-19 which show the magnitude of waterborne traffic over the entire area where the oil products originating from the proposed tracts may be transported by barges or tankers.

Of the 417 million tons (379 million metric tons) of freight that passed through the 12 ports and harbors in 1973 as shown in Table G-19, 200 million tons (182 million metric tons) or almost 48 percent was crude oil and petroleum products. Also, of these same 417 million tons (379 million metric tons) of freight, 141 million tons (128 million metric tons), or approximately 34 percent moved in foreign trade (imports plus exports) and of this foreign trade 32 million tons (29 million metric tons), or 33 percent was crude oil and petroleum products.

## TABLE G-19

## FREIGHT TRAFFIC AT MAJOR PORTS OF THE GULF COAST, NEW ORLEANS - CORPUS CHRISTI

Freight Traffic (Short Tons X 1000)
- 1973 -

| Port | Total Freight Traffic | (SIC 13) Crude Petroleum | (SIC 29) Petroleum Products | Total Foreign Trade | Total Petroleum in Foreign Trade | Petroleum Products as a % of Foreign Trade | Petroleum Products in Foreign Trade as a % of Total Port Activity |
|---|---|---|---|---|---|---|---|
| New Orleans | 136,104 | 23,236 | 20,925 | 46,472 | 3,490 | 08 | 03 |
| Baton Rouge | 53,568 | 5,115 | 15,870 | 17,442 | 2,107 | 12 | 04 |
| Lake Charles | 16,505 | 7,766 | 3,763 | 2,578 | 1,251 | 45 | 08 |
| Orange | 1,280 | 72 | 61 | 70 | 00 | 00 | 00 |
| Beaumont | 34,491 | 11,342 | 13,865 | 9,618 | 4,908 | 51 | 14 |
| Port Arthur | 24,931 | 7,153 | 14,905 | 6,475 | 4,347 | 67 | 18 |
| Houston | 88,518 | 11,390 | 31,753 | 33,429 | 7,371 | 22 | 08 |
| Texas City | 19,959 | 4,844 | 8,728 | 3,279 | 2,575 | 79 | 13 |
| Galveston | 6,887 | 32 | 319 | 5,250 | 231 | 04 | 03 |
| Freeport | 7,348 | 2,410 | 617 | 3,420 | 1,933 | 57 | 26 |
| Corpus Christi & Harbor Island | 27,171 | 7,225 | 8,569 | 13,067 | 3,765 | 29 | 14 |
| TOTALS | 416,782 | 80,585 | 119,375 | 141,110 | 31,978 | 23% | 8% |

TOTAL PETROLEUM PRODUCTS AS A % OF TOTAL PORT ACTIVITY 0% 48%

Source: U.S. Dept. of the Army, Corps of Engineers. Waterborne Commerce of the United States. 1973.

The Gulf Coastal Zone is well served by all forms of transportation (General Gulf Visual No. 6). An extensive network of highways and rail lines connect all major ports with inland areas. Transportation throughout the coastal counties is primarily via roads and highways. The following table gives total roads and highways mileage by state and total number of motor vehicle registrations (autos, trucks and buses) by state.

[Registration figures rounded to nearest thousand]

| | Road and highway mileage, 1971 | Motor vehicle registrations, 1972 |
|---|---|---|
| Louisiana | 53,340 | 1,942,000 |
| Texas | 248,340 | 7,316,000 |

From U.S. Federal Highway Administration, Highway Statistics, 1971.

Because of their geographic location, the coastal counties are also served extensively by waterborne transportation systems. A number of important U.S. ports are within the Texas and Louisiana area.

The Port of New Orleans is the second largest port in the nation, Houston is the third largest and Corpus Christi is the ninth largest U.S. port. The deep water ports along the Texas coastline are Beaumont, Brownsville, Corpus Christi, Freeport, Galveston, Houston, Orange, Port Arthur, Port Isabel, Port Lavaca, Point Comfort, Texas City and Sabine Pass Harbor.

## LOUISIANA

The major arteries of Louisiana are the rivers and waterways, and the Mississippi River is the principal route. Two major interstate highways cross the northern and southern parts of the State and are paralleled by the intracoastal waterway, air, and rail transportation. The following description of the transportation systems in the Louisiana coastal zone is quoted from the Louisiana Advisory Commission on Coastal and Marine Resources, (1973a).

*Highway transportation:*

In the coastal zone, Louisiana maintains more than 9,700 km of non-rural roadway. The principal traffic routes through the coastal zone are shown in Figure G-6. The coastal zone also has more than 11,300 km of local rural roads.

The area along the coast generally has suffered from a lack of feeder roads. This is traceable to the fact that soil conditions in the area make road construction costly.

*Railroad transportation:*

In 1970, there were more than 6,900 km of main line track in Louisiana. Figure G-7, presents an outline of this system.

The primary east-west line in the coastal parishes is Southern Pacific, which runs from New Orleans westward to Morgan City, Lafayette, Lake Charles and ultimately to California. The main line roughly parallels the coast but is located well inland.

The Missouri Pacific traverses an east-west route roughly parallel to U.S. 190.

Texas Pacific serves the western bank of the Mississippi River as far south as Venice, Illinois Central also provides a north-south line from New Orleans to Illinois. Southern Railway System and the Gulf, Mobile and Ohio Railroad Company provide north-south service around the eastern end of Lake Pontchartrain. The Louisville and Nashville Railroad provides service from New Orleans eastward along the Mississippi Gulf Coast.

*Air transportation:*

The coastal zone of Louisiana is served by four commercial airports. These include:

Baton Rouge—Ryan Field
Lafayette—Lafayette Municipal Airport
Lake Charles—Lake Charles Municipal Airport
New Orleans—Moisant (New Orleans International) Airport

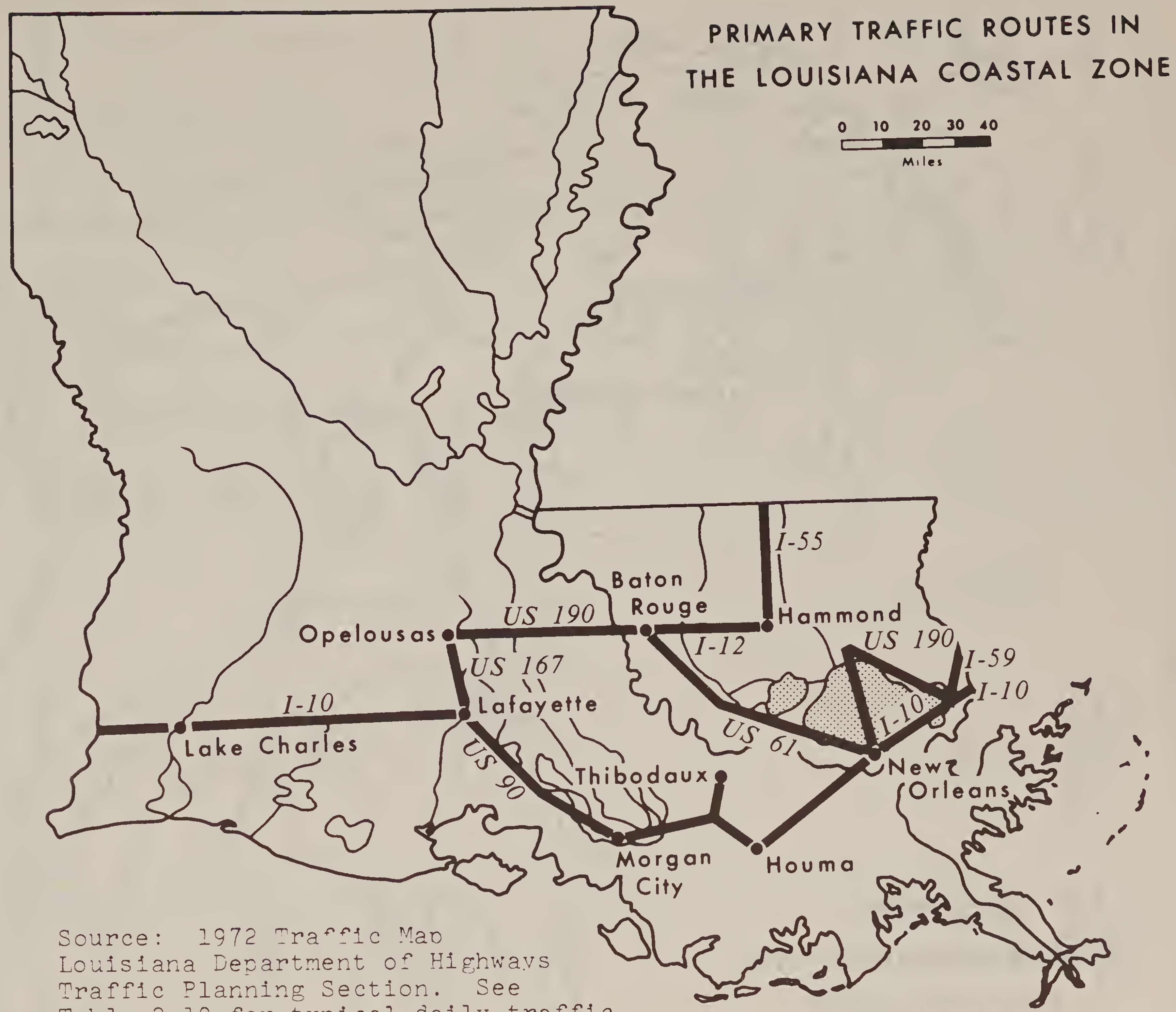
Numerous other cities and towns, have unlighted, hard surface, landing strips or airports. However, most of the air facilities are located at least 16 km inland. A number of heliports and seaplane facilities have been constructed on the coast. They are generally concentrated around Morgan City, Grand Isle and Venice and serve the petroleum industry as refueling stops for aircraft transporting workmen to offshore oil rigs from other airports in the more populated areas.

*Pipeline transportation:*

There are 31 gas transmission companies operating in Louisiana and 34 petroleum and petroleum product pipeline companies. Most pipelines are automated.

That network is likely to grow for natural gas activity and stabilize for petroleum activity based on production predictions in the following two tables prepared by Associated Louisiana Planning Consultants, Incorporated for the Comprehensive State Plan (Table G-20 and G-21).

Development of a deep-draft port in the Gulf of Mexico in the vicinity of the Mississippi River



PRIMARY TRAFFIC ROUTES IN THE LOUISIANA COASTAL ZONE

Fig. 6-6

Source: 1972 Traffic Map
Louisiana Department of Highways
Traffic Planning Section. See
Table 2.10 for typical daily traffic
load.

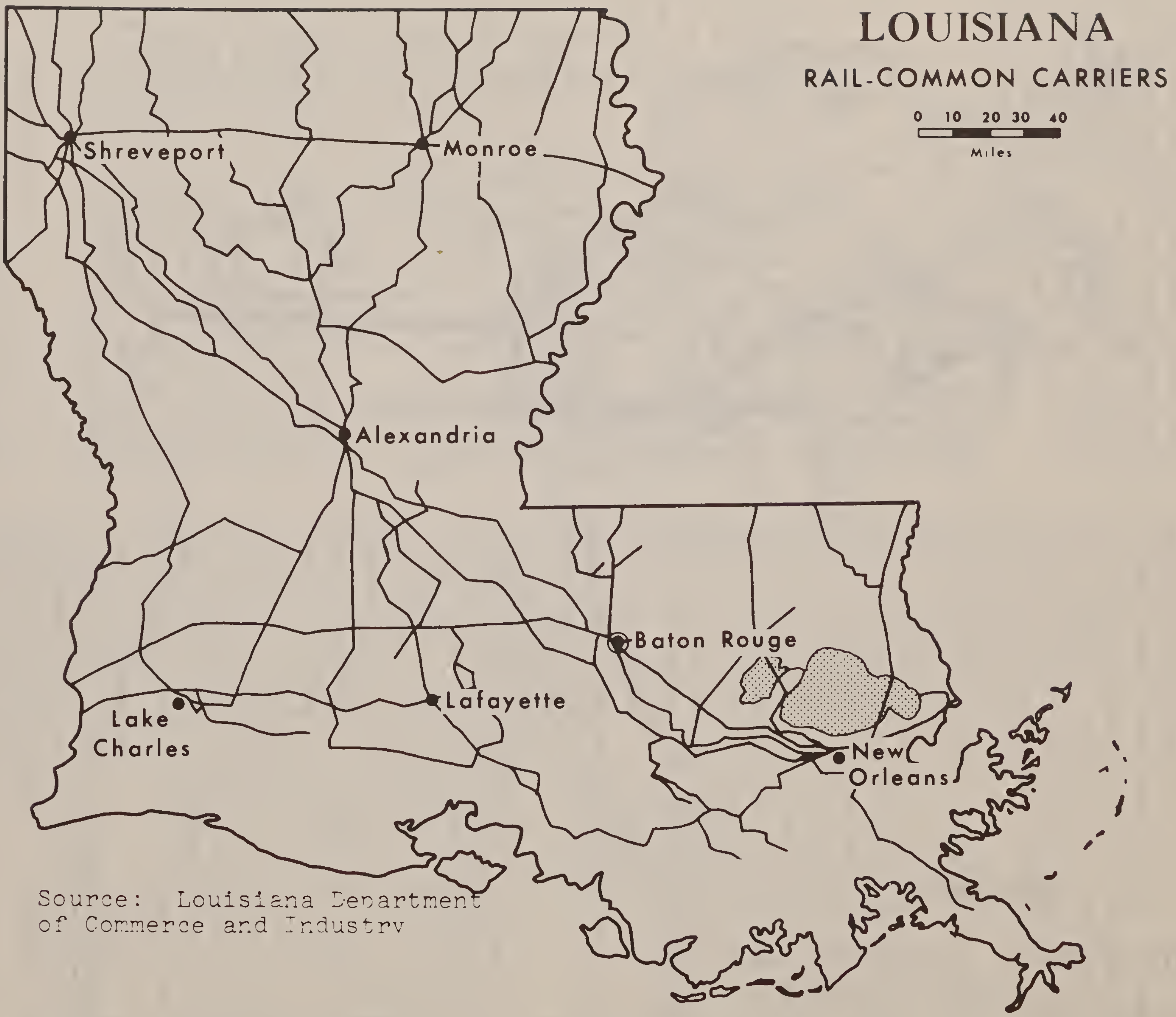


Fig. G-7 Source: Louisiana Department of Commerce and Industry

## Table G-20

## Sales by Louisiana Producers of Natural Gas to Natural Gas Pipeline Companies

| Year | Million Cubic Feet | Revenue | Cents per Million Cubic Feet | % of National Sales |
|---|---|---|---|---|
| 1953 | 965,000,000 | $ 88,000,000 | 9.1 | 20.5 |
| 1961 | 2,494,738,257 | 498,993,710 | 20.0 | 29.9 |
| 1970 | 4,990,000,000 | | | |
| 1975 | 5,900,000,000 | | | |
| 1980 | 6,500,000,000 | | | |
| 1985 | 7,150,000,000 | | | |

## Table G-21

## Petroleum Pipeline Activity

| Year | Miles of Pipeline In Place | Pipeline Fill (1,000 Barrels) | Miles of Produce Line | Miles of Crude Truck Line |
|---|---|---|---|---|
| 1953 | 5,659 | 2,474 | 616 | 2,872 |
| 1961 | 6,598 | 3,791 | 1,704 | 2,465 |
| 1970 | 6,765 | 5,770 | 2,045 | Stable |
| 1975 | 7,000 | 5,920 | 2,450 | |
| 1980 | 7,210 | 6,230 | | |
| 1985 | 7,430 | 6,570 | | |
| 2000 | 7,650 | 7,460 | | |

Source: Louisiana Office of State Planning, 1972. Initial elements toward a comprehensive state plan.

may anticipate construction of connector pipelines to the offshore terminal as the main method of moving bulk liquids.

*Port facilities and water transportation:*

At least 8 km of navigable streams and 1,800 km of intercoastal waterways are located in the state (Louisiana Planning Corporation, 1972. Vol. 1, p. 322). These waterways include the Mississippi River and the Gulf Intracoastal Waterway which are major waterways for the nation's waterborne commerce. Other notable waterways include the Calcasieu, Atchafalaya, Ouachita, Mermentau, Vermilion, and Pearl River, Barataria Bay, Bayou La Fourche, the Houma Navigation Canal, and the Bayous Petit Anse, Tige, Carlin and Teche.

Several major ports have developed in southern Louisiana. Three of these, New Orleans, Baton Rouge, and Lake Charles, rank among the major ports of the United States.

New Orleans is the largest port on the Gulf of Mexico. Upstream from New Orleans on the Mississippi River is the Port of Baton Rouge, the seventh ranked port in the nation in terms of tonnage. Bulk cargoes, petroleum and petroleum products, grains, and ores flow through these ports. Lake Charles, the state's third deepwater port, ranks twentieth in the nation. Lake Charles has bulk cargo operations consisting primarily of petroleum and its derivative products, as well as moderate amounts of general cargo. Total tonnage handled by these three ports from 1955-1973 is shown in Table G-22.

The following description of Louisiana ports was abstracted from U.S. Department of the Army, 1973.

NEW ORLEANS:

The Mississippi River has a clear and unobstructed channel maintained to a depth of 12 m from New Orleans to the mouth of the river. The frontage for deepwater vessels within the port limits includes approximately 92 km along the riverbanks, 18 km on the Inner Harbor Navigation (Industrial) Canal, and approximately 126 km on the Mississippi River—Gulf Outlet. The Inner Harbor Navigation (Industrial) Canal in the City of New Orleans connects the Mississippi River with Lake Pontchartrain, the Gulf Intracoastal Waterway east of New Orleans and the Mississippi River—Gulf outlet ship channel.

There are about 295 piers, wharves, and docks in the Port of New Orleans area. Twenty-three waterfront facilities are equipped to receive and/or ship petroleum products; several of these facilities provide bunkering services for vessels. Four companies maintain facilities for public storage, drumming, blending, packaging and distributing of various types of bulk liquids. They operate six wharves along the right bank of the Mississippi River with waterside connections and pipelines extending to storage tanks in the rear with total storage capacity of about 2,839,000 barrels.

The port area is served by six railway companies. Interstate, Federal, and state highways connect New Orleans with other points in Louisiana and the United States. See Table G-22 for commodities and tonnage shipped on the Mississippi River system.

BATON ROUGE:

The Port of Baton Rouge, Louisiana, is on both banks of the Mississippi River 418 km from deep water in the Gulf. It is at the head of the deep-draft channel of the Mississippi River. The port is also served by a direct connection with the Gulf Intracoastal Waterway via the Port Allen Lock and the Gulf Intracoastal WaterwayAlternate Route which extends from Morgan City to Port Allen. The existing project dimensions above New Orleans are 12 meters deep (mean low water) by 152 meters wide.

Thirteen waterfront facilities are equipped to receive and/or ship crude oil and petroleum products. There are about 890 storage tanks capable of storing approximately 23,269,999 barrels of crude oil and petroleum products.

The port area of Baton Rouge is served by the Illinois Central Railroad; Louisiana & Arkansas Railway (Kansas City Southern Lines). Interstate, Federal and state highways connect Baton Rouge with other points in Louisiana and the United States.

PORT OF LAKE CHARLES:

The port of Lake Charles is in the southeastern part of the State of Louisiana and embraces an area of 526 square kilometers. The Calcasieu River flows in a southerly direction from the port for a distance of 56 km to enter the Gulf of Mexico.

The existing project provides for a 13 meter by 244 meter approach channel with a 12 meter by

### TABLE G-22

### TOTAL TONNAGE HANDLED BY MAJOR LOUISIANA PORTS, 1955-1973
(In Tons of 2,000 Pounds)

| Port | 1955 | 1960 | 1965 | 1967 | 1969 | 1973 |
|---|---|---|---|---|---|---|
| Baton Rouge | 16,489,779 | 26,585,815 | 31,658,797 | 37,273,286 | 40,845,124 | 53,568,530 |
| Lake Charles | 15,396,366 | 17,433,441 | 14,469,783 | 16,697,672 | 16,154, 84 | 16,505,262 |
| New Orleans | 47,082,734 | 56,671,652 | 88,876,872 | 111,491,062 | 113,426,557 | 136,104,315 |
| U. S. Total | 1,016,136,785 | 1,099,850,431 | 1,272,896,243 | 1,336,606,078 | 1,448,711,541 | |
| Louisiana as a Percentage of U. S. | 7.67 | 9.15 | 10.60 | 12.38 | 11.77 | |

Source: U. S. Department of the Army, Corps of Engineers, Waterborne Commerce of the United States, 1974.

122 meter channel to the wharves of the port of Lake Charles.

Storage facilities are maintained for about 13,200,000 barrels of crude oil and refined petroleum products. The port area is served by the Kansas City Southern Railway, the Missouri-Pacific Railroad, and the Southern Pacific Company. Interstate Highway 10, U.S. Highway 90 and state highways connect Lake Charles with other parts of Louisiana and the United States.

The Gulf Intracoastal Waterway, which extends from Apalachee Bay, Florida, to Brownsville, Texas, crosses the Calcasieu River about 18 km below the city of Lake Charles. The Waterway section to the east provides a connection with the Mississippi River System at New Orleans, and westward from the Calcasieu River to the Sabine-Neches Waterway.

### INTRACOASTAL SHIPPING:

Aside from deep-draft ocean shipping, Louisiana is a key focal point for inland waterway traffic. Inland barge traffic not only links the deepwater ports to the interior of the nation but also provides important support for the industrial structure of coastal Louisiana.

In terms of cargo destined for ocean shipping, the principal commodities carried on the inland waterways are petroleum and petroleum products, grains and grain products, aluminum ores, concentrates and scrap, soybeans, and liquid and dry sulfur. The domestic cargo tonnage moved along Louisiana waterways consists primarily of petroleum and petroleum products, grain and grain products, soybeans, sand, gravel, crushed rock, iron and steel products, sulfur, and other chemicals.

Barge traffic is especially important to the petroleum and chemical industries in Louisiana since it not only supplements pipelines to a considerable extent but also provides low-cost movement of refined petroleum and chemicals to the interior of the nation and to the deep-water ports for trans-shipment. The existence of barge service concentration of petro-chemical facilities adjacent to water sites in Louisiana.

The importance of the petroleum related industries can be seen in Table G-23. Of the total tonnage handled at the major Gulf Coast ports from New Orleans through Brownsville, approximately 23 percent consisted of "Crude Petroleum" (SIC 13), and 27 percent consisted of "Petroleum and Related Industries" (SIC 29).

### TEXAS

The principal reference for the following text and figures was Transportation in the Texas Coastal Zone (Texas A & M University, 1973). Much of the following was taken verbatim from that reference.

### HIGHWAY TRANSPORTATION

Highways form the backbone of the transportation system serving the land areas within the Coastal Zone. Most of the 19,308 km of highways crisscrossing the Coastal Zone are presently operating at less than half of their capacity in rural areas; however, traffic volumes increase sharply as these highways approach urban areas.

### RAIL TRANSPORTATION

The Texas Coastal Zone is served by an extensive network of railroads that connect the region to the rest of the State and the nation. The 4,809 km of main-line tracks represent more than 21 percent of all railroad kilometers in Texas.

A total of 55 million tons (50 million metric tons) of rail freight is estimated to originate, terminate, or pass through the Coastal Zone each year. This represents about 28 percent of all rail freight tonnage reported by Texas railroads. The bulk of this rail traffic is estimated to be in corridors connecting the Coastal Zone to other regions.

A comparison of the estimated traffic volumes in major rail corridors serving the Coastal Zone is presented in Figure G-8. The heaviest rail traffic occurs in the corridor connecting Houston to Dallas-Fort Worth area and points north. An estimated 21 million tons (19 million metric tons) per year are carried in this corridor. None of the rail corridors serving the Coastal Zone are presently operating at more than 20 percent of the basic capacity provided by the rail lines.

### AIR TRANSPORTATION

Eight airports in the Coastal Zone are presently served by scheduled air passenger service. Almost three million passengers boarded planes at these airports in 1970.

### PIPELINE TRANSPORTATION

The total capacity of pipelines entering or leaving the coastal zone is sufficient to transport more than 150 million tons of crude oil and petroleum products each year. This capacity is distributed among the major corridors as shown in Figure G-9. In addition, numerous gas pipelines traverse the area.

## TABLE G-23

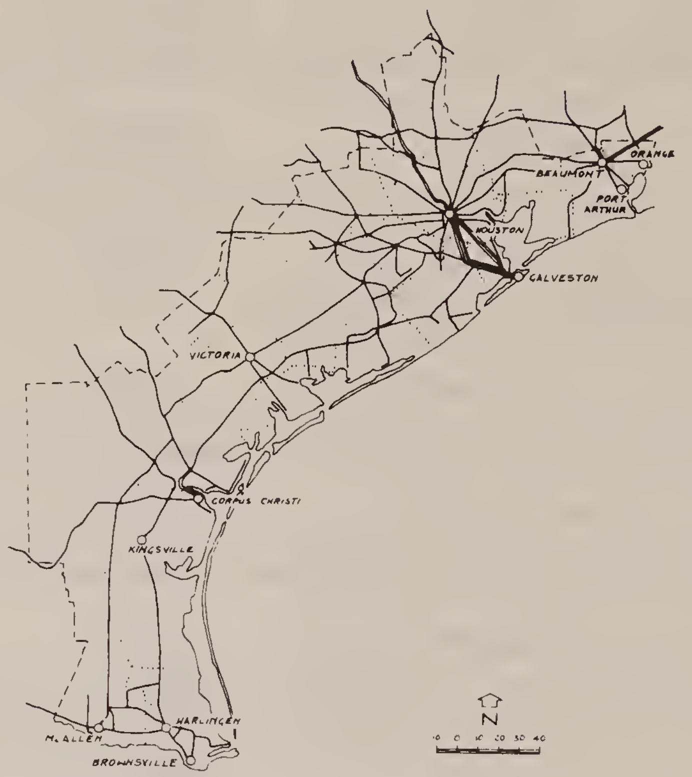
## FREIGHT TRAFFIC AT MAJOR PORTS OF THE GULF COAST, NEW ORLEANS-BROWNSVILLE

Freight Traffic (Short Tons X 1000)
- 1974 -

| PORT | TOTAL | CRUDE PETROLEUM (SIC 13) | PETROLEUM PRODUCTS (SIC 29) |
|---|---|---|---|
| New Orleans | 144,189 | 23,742 | 22,826 |
| Baton Rouge | 59,126 | 6,491 | 17,030 |
| Lake Charles | 16,564 | 7,858 | 4,020 |
| Orange | 1,331 | 50 | 62 |
| Beaumont | 33,504 | 12,879 | 12,089 |
| Port Arthur | 27,799 | 10,302 | 13,915 |
| Houston | 89,106 | 18,809 | 30,273 |
| Texas City | 20,152 | 6,273 | 7,362 |
| Galveston | 7,171 | 209 | 149 |
| Freeport | 8,898 | 3,065 | 1,176 |
| Corpus Christi and Harbor Island | 37,781 | 13,077 | 13,076 |
| Brownsville - Port Isabel | 2,837 | 379 | 664 |
| TOTALS | 448,458 | 103,134 | 122,642 |

Compiled from figures in U. S. Department of the Army, 1974.

RAIL LINES IN THE TEXAS COASTAL ZONE



*An extensive network of 2989 miles of main-line railroads serves the Texas Coastal Zone. Excellent rail connections link the Coastal Zone to the rest of the State and the nation.*

**FIG** G-8

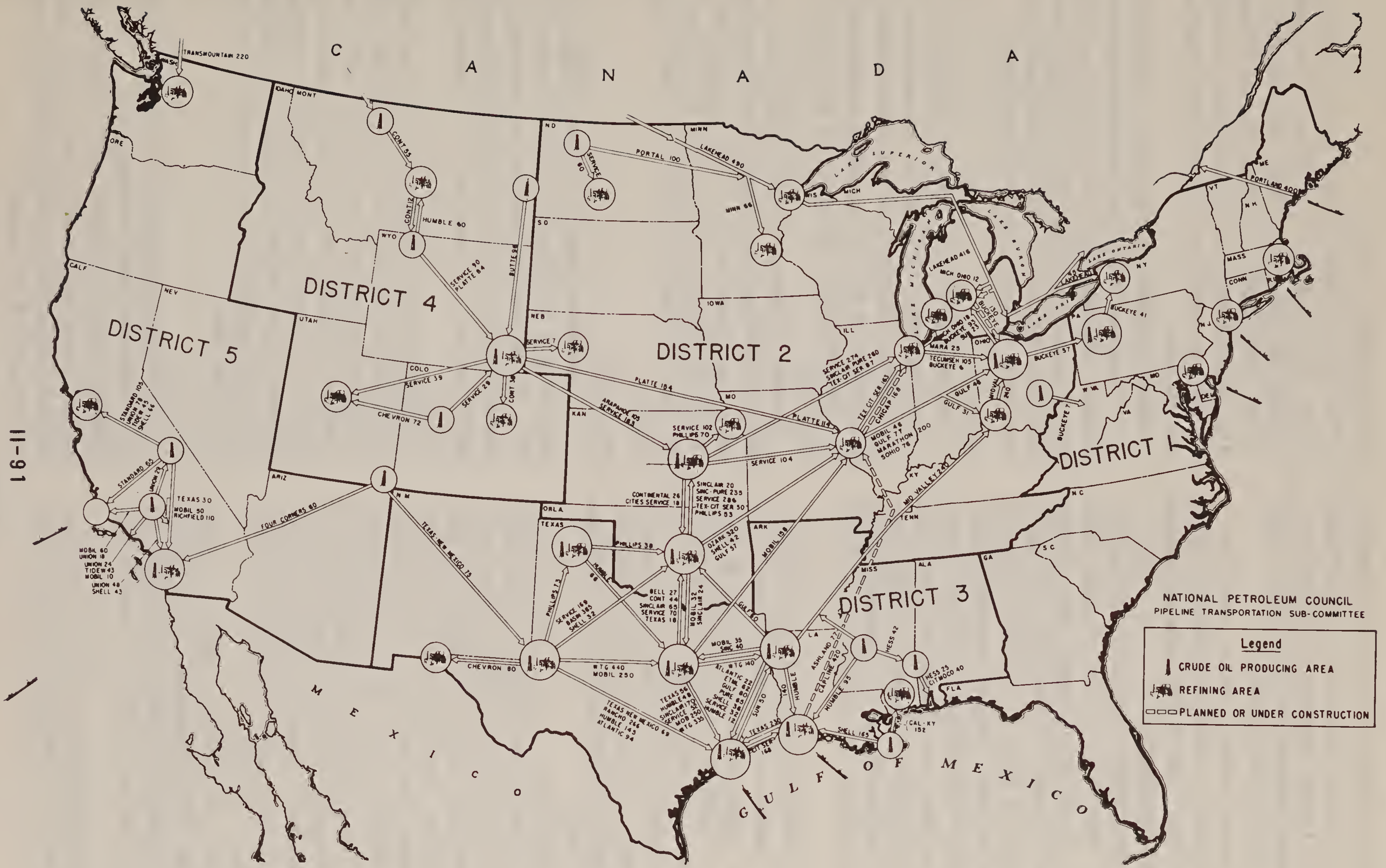


Figure G-9 Crude Oil Pipeline Capacities

*Source: National Petroleum Council*

### PORT FACILITIES AND WATER TRANSPORTATION

Texas ports handle three basic types of waterborne traffic: foreign, domestic and internal. Of the total tonnage handled 64 percent was shipped out, and 36 percent was received.

Of the ocean traffic, about two-thirds is domestic commerce and the remainder is in foreign trade. The bulk of this outbound tonnage is liquid petroleum products.

The waterway traffic is primarily on the Gulf Intracoastal Waterway, which extends from Brownsville, Texas, to Apalachee Bay, Florida. Its 1791 km of canals, of which 681 km are in Texas, connects all ports on the Gulf of Mexico to more than 9654 km of inland waterway centering on the Mississippi River. Recent industrial expansion in the Texas coastal zone has been closely related to the waterway, as more than four out of every five additional tons of waterborne traffic developed in the past 15 years have been on the canal.

No locks are required through Texas, as all portions of the canal are at sea level. Almost 70 million tons (64 million metric tons) of goods were loaded onto or unloaded off of barges at Texas ports each year from 1967 to 1970.

About 36 million tons (33 million metric tons) of waterway traffic crossed the Texas-Louisiana border in 1970, about 60 percent of which was coming into Texas.

Since approximately half of the nation's petrochemical industry and one-fourth of its refining capacity is located in the Texas coastal zone, products from these industries comprise the bulk of total waterborne tonnage for both ocean-going and barge traffic. The importance of the petroleum related industries can be seen in Table G-24. Of the total tonnage transported along sections of the Gulf Intracostal Waterway approximately 19 percent consisted of "Crude Petroleum" (SIC 13), and 42 percent consisted of "Petroleum and Related Industries"—(SIC 29).

Including the petrochemical industry, it has been estimated that approximately 85 percent of all tonnage handled at Texas ports consists of crude oil or petroleum products (University of Texas, 1973).

The following description of Texas ports was abstracted from U.S. Department of the Army (1973).

### PORT ARTHUR

The port of Port Arthur has an authorized depth of 13 meters and a width of 244 meters through the outer bar channel and a depth of 12 meters and a width of between 60 and 203 meters. The principal waterborne commodities handled at the port are crude petroleum, petroleum products, and chemicals.

Storage facilities include about 25,932,000 barrels of storage for crude oil and refined petroleum products. Railroad facilities include about three km of marginal trackage. Three federal highways and state highways connect Port Arthur with other parts of Texas and the United States.

### ORANGE

The channel to the port of Orange has an authorized depth of nine meters and a width of 46 to 60 meters. The principal waterborne commodities handled at the port are shell, crude petroleum, and chemicals. There are 35 piers, wharves and docks.

Storage facilities include transit sheds and about 447,000 barrels of storage for crude oil and refined petroleum products. The Orange area is served by Interstate Highway 10, U.S. Highway 90, two railroad companies and other state highways.

### BEAUMONT

This port has an authorized channel depth varying from nine to 12 meters in width varying from 60 to 120 meters. The principal waterborne commodities handled at the port are crude petroleum, petroleum products, chemicals, liquid sulphur and wheat.

Storage facilities include elevators for grain, dry storage space, and about a 39,500,000 barrel capacity of storage tanks for crude oil and refined petroleum products. The port area of Beaumont is served by several railway companies. Interstate Highway 10 and several U.S. and state highways connect Beaumont with other points of Texas and the United States.

### GALVESTON

The Galveston Channel has an authorized depth of 12 meters and width of 366 meters.

Storage facilities include grain elevators, dry storage, cooler and freezer space, storage tanks for liquid sulphur, and storage facilities for an unlimited supply of dry sulphur.

TABLE G-24

# FREIGHT TRAFFIC ALONG SECTIONS OF THE GULF INTRACOASTAL WATERWAY

Freight Traffic (Short Tons X 1000)
-1974-

| WATERWAY SECTION | TOTAL | CRUDE PETROLEUM (SIC 13) | PETROLEUM PRODUCTS (SIC 29) |
|---|---|---|---|
| Sabine River to Galveston | 40,034 | 9,597 | 16,388 |
| Galveston to Corpus Christi | 23,310 | 4,306 | 4,906 |
| Corpus Christi to Brownsville | 2,711 | 334 | 698 |
| Totals | 66,055 | 14,237 | 21,992 |

Source: Compiled from figures in U.S. Department of the Army, 1974.

Waterfront terminals at Galveston are served by a railroad which connects with several other railroads serving Galveston and the port area. Interstate 45 and State Highway 87 also connect Galveston with the Texas mainland.

### HOUSTON

The Houston Ship Channel affords access for ocean-going vessels from the Gulf of Mexico to Houston. It also provides access to barge traffic from the Gulf Intracoastal Waterway. Some of the principal commodities handled at the port are petroleum and petroleum products, sand and shell, fertilizer and fertilizer materials, steel mill products, grain, sulphur, clay and earths, and chemicals. There are 218 piers, wharves and docks in the vicinity of the port of Houston.

Storage facilities include five grain elevators, 21 warehouses, cooler and freezer space, and about 11,928,000 barrels of storage tanks for crude oil and refined petroleum products. The port area of Houston is served by many railroads. Two interstate highways and several U.S. and state highways connect Houston with other points in Texas and other points in the United States.

### TEXAS CITY

The dimensions of the authorized channel are 12 meters deep, 122 meters wide, and about six km long, with 12 meter depths also authorized for the turning basins and industrial canal.

The harbor area includes about 11,175,000 barrels of storage for crude oil and refined petroleum products. The Texas City Terminal Railway has marginal tracks in the vicinity of the harbor area and connects with other railroads. State Highway 197 connects the Texas City area with other state and Federal highways.

### FREEPORT

The port of Freeport is a major port for shipping chemicals and petroleum products.

Storage facilities include about 20,066 square meters of transit sheds, private storage facilities for about 700,000 barrels of crude oil, and for about 1,350,000 barrels of petroleum products. Railroad facilities include about 914 meters of marginal trackage. Federal and state highways connect Freeport with other parts of Texas and the United States.

### PORT OF PORT O'CONNOR

The waterfront facilities in the area, excluding shallow-draft channels and turning basins, consist of a turning basin with approximately 914 meters of usable berthing space and about 2,892 square meters of transit sheds. There are no storage facilities for crude petroleum. Railroad facilities include trackage connecting to the Missouri-Pacific Railroad. State Highway 35 is the primary highway.

### PORT OF CORPUS CHRISTI

Storage facilities include about a 25,430,000 barrel capacity of storage tanks for crude oil and refined petroleum products.

All of the publicly-owned, as well as some of the privately-owned waterfront terminals at the port of Corpus Christi are served by terminal trackage. Several U.S. and state highways connect with other parts of Texas and the United States.

### PORT OF BROWNSVILLE

Port Brownsville is the southernmost port in Texas and the southern terminus of the intracoastal waterway system.

The main harbor consists of about 5 km of improved waterfrontage, cargo docks, covered and open storage, and grain storage. Railroad service is provided by three companies and the harbor is also served by the Gulf Intracoastal Waterway and state and federal highways.

### PORT OF PORT O'CONNER

The waterfront facilities in the area, excluding shallow-draft channels and turning basins, consist of a turning basin with approximately 914 meters of usable berthing space and about 2,892 square meters of transit sheds. There are no storage facilities for crude petroleum. Railroad facilities include trackage connecting to the Missouri-Pacific Railroad. State Highway 35 is the primary highway.

## Commercial Fishery Resources

By far the most productive region of the Gulf of Mexico, where most of the fishery concentrates, is around the Mississippi Delta, with approximately 1/3 to 2/5 of the total production taken on the eastern side (Juhl, 1974). The total U.S. landings of the 1974 were 4.9 billion pounds (U.S. Dept. Commerce, 1975) valued at $898.5 million at the ex-vessel level. Landings in the Gulf waters of the U.S. accounted for 36.1% or 1.77 billion pounds and 26.8% or 240.8 million of the U.S. catch.

The Gulf fishery is dominated by the shell fisheries, and especially by shrimp, crabs and oysters (with smaller amounts of clam and scallops), usually worth three or four times more than the much greater volume of fin fish. The main shrimp fishery in the Gulf area includes brown, white and pink shrimp. These are taken almost exclusively with trawls, in depths ranging from one to forty fathoms. Other shrimp taken commercially are the sea bobs and royal reds.

Based on 1973 statistics for grid zones 10-21, brown shrimp (*Penaeus aztecus*) comprised 59% of the catch, white shrimp (*P. setifeus*) 37%, and pink shrimp (*P. duorarum*) one percent. Catches of sea bob (Xiphopeneus kroyeri) and the deepwater royal reds (*Hymenpenaeus robustus*) were also reported, and accounted for three percent of the catch. The areas of greatest harvest were grid zones 19, 13, and 14 (Table G-25). Visual No. 5 for the Western Gulf and Central Gulf depict grid zones and location of major coastal zone and offshore fishery areas. The percent of brown and white shrimp catch for 1970-1974; for offshore from the Mississippi River to Texas are shown in Tables G-26 and G-27.

In 1974 the Gulf states shrimp fishery accounted for 50 percent of the total volume and 77 percent of the total value. In addition, Texas was again the leading state in value with $67.7 million, and the second state in production with 78.7 million pounds. Louisiana was second in value with $32.1 million, and third in production with 59.5 million pounds.

Compared with 1973, landings along the Gulf coast of 185.7 million pounds increased two percent, but the value ($137.4 million) declined 21 percent. For oyster production, Louisiana led with 9.0 million pounds, followed by the west coast of Florida with 2.4 million and Texas with 1.3 million pounds. The oyster harvest declined generally in the Gulf area, principally because of floods in 1972 and 1973.

Louisiana also led in crab production with 20.6 million pounds. Production for the Gulf states was 39.6 million pounds which represented six percent less than in 1973.

Finfish volume for the Gulf states is dominated by menhaden. It is number one in both volume and value for the Gulf States. Landings in 1974 were 1,295.9 million pounds—223.0 million (21 percent) more than in 1973 or 65.5 percent of the U.S. menhaden catch. Louisiana led all states with 1,079.3 million pounds—up 184.4 million compared with 1973.

Hopkins and Petrocelli (1974) stated that nearly all of the Gulf coast catch, including practically all of the menhaden, is made within the waters of the United States, or in international waters within a few miles of the U.S. coast. Of the important commercial fishes, only groupers and red snappers are caught mainly beyond the 12-mile limit, and they make up only one percent of the volume and two percent of the value of the total Gulf coast catch. However, of the shrimp landed at Gulf ports some 20 percent are caught in international waters off foreign shores, mainly Mexican.

As Gunter (1967) has pointed out, 97.5 percent of the total commercial fisheries catch of the Gulf states is made of estuarine species, that is, fishes or shell fishes that spend all or part of their lives in estuaries. A few species, such as the commercial oyster, live their lives in estuarine waters.

On the Gulf coast as a whole, the usual ranking of the most important commercial fishes is as shown below:

| *By volume* | *By value* |
|---|---|
| Menhaden | Menhaden |
| Mullet | Red Snapper |
| Croaker | Mullet |
| Red Snapper | Spotted Seatrout |
| Groupers | Croaker |
| Spanish Mackerel | Groupers |
| Spotted Seatrout | Pompano |
| Red Drum | Spanish Mackerel |
| Flounders | Red Drum |
| Black Drum | Flounders |
| King Whiting | King Mackerel |
| White Seatrout | Black Drum |
| Sheepshead | White Seatrout |
| | Sheepshead |

Table G-28 is a statistical summary of landings, fisherman, plants and ranking in the United States for the Gulf States.

A visual representation for the coastal zone and offshore fisheries is in Visual No. 5; western and central Gulf of Mexico. In addition, two years (1972-1973) averages for brown, white and pink shrimp are given and location of royal red shrimp grounds, major inshore shrimp areas, major crabbing areas and oyster grounds are illustrated. Finfish are identified as to major species, both sport and commercial, and grid zones in which they are commonly caught. Shell dredging areas are also identified.

Table G-25 SHRIMP CATCH BY GRID ZONE FOR 1973 1/

| SPECIES | GRID<br>13 | 14 | 19 |
|---|---|---|---|
| Brown | 7,957,511 | 7,269,074 | 7,329,790 |
| White | 3,293,747 | 2,431,257 | 6,384,465 |
| Pink | 12,181 | -0- | -0- |
| Other | 276,820 | 277,741 | 2,941 |
| TOTAL | 11,540,259 | 9,978,072 | 13,717,196 |
| Trips | 65,000 | 65,660 | 35,707 |

1/ Includes inland waters and weight in pounds (heads off).

Source: Gulf Coast Shrimp Data Summary
U.S. Department of Commerce, 1973

Table G-26 PERCENT BROWN SHRIMP LANDINGS (LBS.) BY WATER DEPTH, 1970-1974, OFFSHORE - MISSISSIPPI RIVER TO TEXAS

| Depth (ft.) | 1970 % | 1971 % | 1972 % | 1973 % | 1974 % |
|---|---|---|---|---|---|
| 0-60 | 24.63 | 33.87 | 23.01 | 37.17 | 20.75 |
| 60-120 | 28.24 | 35.74 | 22.66 | 8.73 | 23.74 |
| 120-180 | 34.67 | 18.96 | 35.39 | 16.3 | 29.83 |
| 180+ | 12.45 | 11.42 | 18.95 | 37.34 | 25.69 |

Source: Gulf Coast Shrimp Data, Summary
U. S. Department of Commerce, 1974

Table G-27 PERCENT WHITE SHRIMP LANDINGS (LBS.) BY WATER DEPTH, 1970-1974, OFFSHORE - MISSISSIPPI RIVER TO TEXAS

| Depth (ft.) | 1970 % | 1971 % | 1972 % | 1973 % | 1974 % |
|---|---|---|---|---|---|
| 0-60 | 85.04 | 89.53 | 90.61 | 94.85 | 91.55 |
| 60-120 | 14.03 | 9.55 | 8.80 | 4.78 | 6.65 |
| 120-180 | 0.87 | 0.83 | 0.44 | 0.22 | 1.67 |
| 180+ | 0.07 | 0.09 | 0.15 | 0.17 | 0.12 |

Source: Gulf Coast Shrimp Data, Summary
U. S. Department of Commerce, 1974

Table G-28

## LANDINGS BY STATES FOR GULF OF MEXICO 1973 - 1974 1/

| | 1973 | | | | 1974 | | | |
|---|---|---|---|---|---|---|---|---|
| | Thousand Pounds | % | Thousand Dollars | % | Thousand Pounds | % | Thousand Dollars | % |
| Gulf | 1,547,471 | | 268,146 | | 1,772,531 | | 240,836 | |
| Alabama | 39,749 | 2.6 | 18,080 | 6.8 | 36,962 | 2.1 | 17,087 | 7.1 |
| Florida (Gulf) | 99,200 | 6.4 | 43,462 | 16.2 | 104,662 | 5.9 | 48,245 | 20.0 |
| Louisiana | 1,035,959 | 66.9 | 98,446 | 36.7 | 1,228,906 | 69.3 | 86,694 | 36.0 |
| Mississippi | 271,594 | 17.6 | 16,887 | 6.3 | 304,794 | 17.2 | 16,355 | 6.8 |
| Texas | 100,969 | 6.5 | 91,271 | 34.0 | 97,203 | 5.5 | 72,455 | 30.1 |

Ranking in U. S. (1974) by Landings

| State | Catch | Value |
|---|---|---|
| Louisiana | 1 | 3 |
| Texas | 13 | 4 |

Number of Full-Time and Part-Time Commercial Fishermen 1974[2/]

| State | Full-Time | Part-Time | Total |
|---|---|---|---|
| Louisiana | 9,500 | 4,050 | 13,550 |
| Texas | 6,500 | 575 | 7,075 |

Processing and Wholesale Establishments, 1973

| State | Processing Plants | Employment Season | Average Year |
|---|---|---|---|
| Louisiana | 118 | 4,807 | 3,233 |
| Texas | 80 | 3,430 | 2,483 |

| State | Wholesale Plants | Employment Season | Average Year |
|---|---|---|---|
| Louisiana | 108 | 489 | 391 |
| Texas | 80 | 1,491 | 810 |

1/ Landings in interior waters are estimated

2/ All data are estimated

Table G-28 (continued)

PLANTS PRODUCING CANNED AND INDUSTRIAL FISHERY PRODUCTS, AND FISH FILLETS AND STEAKS, 1974

| State | Canned Fishery Products | Industrial Fishery Products | Fish Fillets and Steaks | Total Plants Exclusive of Duplication |
|---|---|---|---|---|
| Louisiana | 17 | 23 | 1 | 40 |
| Texas | - | 1 | - | 1 |

Source: U. S. Department of Commerce 1975, Fisheries of the United States, 1974 - Current Fishery Statistics No. 6700

## Existing Environmental Quality

### Air Quality

Multiple or massive use of air for waste disposal (emissions) in a limited area temporarily degrades the quality (defined as availability for general use) of the air. Evaluation of the potential impact of a proposed additional use of air involves knowledge of the restrictions on additional impacts, the capability of the air to receive additional impacts and the extent of the proposed additional impacts. The remainder of this section examines the first two factors in terms of the legal constraints involved and the existing air quality.

Interstate air quality control regions define areas in which specific controls and standards are applied but which are administered by federal or state jurisdictions. The air quality criteria to be met by a potential pollution source can be complex in that each air quality jurisdiction may have differing criteria. Thus, conceivably, a source in the Houston, Texas, area would have to meet separate criteria imposed by the federal standards (through EPA Region VI), Texas Air Control Board (Texas Region VII), Harris County Division. Table H-1 lists the federal ambient air standards. All individual states are required to adopt standards as stringent as or more stringent than the federal standards. Table H-2 lists the current regulations in force in Texas and Louisiana.

Estimates of air pollution emissions for the counties in the Texas and Louisiana regions have been given in the implementation plans prepared by the various states (Louisiana Air Control Commission (LACC), 1972; and the Texas Air Control Board (TACB), 1973. These data are compiled in Tables H-3 through H-5.

The emission data give quantities of pollutants being emitted into the air, and the air pollution potential gives some indication of the likelihood that the emissions will not be satisfactorily dispersed. Theoretically, air quality data should provide a direct measure of the extent of air pollution in a given area. In fact, coverage is incomplete. Most of the data available are from urban areas, with a few exceptions.

Rather than detail such data as is available at the time of this report, the potential user is referred to the SAROAD system of the Environmental Protection Agency. This provides access to all current and past air quality data, and may be assessed through a specific geographic location.

The quality of air over the proposed area can be degraded from several types of sources including exhaust emissions from stationary power units, service vehicles and by accidental release and combustion of oil or gas. Because of the distance of most of operating facilities in the nearshore tracts air quality degradation could result. To determine the specific effect of emissions on particular areas reference is made to the EPA publication of ''Compilation of Air Pollution Emission Factors'', 1975.

Population and industrial-chemical centers are isolated problem areas. Table H-6 lists the Air Quality Control Regions which have exceeded the national ambient air quality standards. In almost every case, the data are from sampling points located in urban or industrial areas. The trends shown in Table H-6 are based on very limited data. More extensive, although still limited, are the data available from SAROAD. However, the emission estimates in Table H-3 through H-5 are most useful for estimating air quality. Thus, a high carbon monoxide emission level is indicative of high automotive density; and a high hydrocarbon level may indicate petroleum, storage, refining, etc.

The Texas Implementation Plan of 1972 indicated some difficulties in several ACQR's. The following table indicates the priorities assigned to these coastal regions for specific pollutants. Priority I indicates measurements above the primary standards and the requirements for controls to reduce pollutant concentrations.

| | Brownsville (213) | Corpus Christi (214) | Houston (216) | South Louisiana (106) |
|---|---|---|---|---|
| Sulfur dioxide... | III | I | I | I |
| Particulate........ | III | II | I | II |
| Oxidants.......... | III | I | I | I |

This information reflects the region classification as submitted in the original Implementation Plan and the semi-annual updates to this plan through August 15, 1975.

Therefore, in lieu of the above data, it is recognized that there is a severe air quality problem along the Texas coast. Since the Texas Implementation Plan of 1972 new and more improved measurement methods have been developed. This allowed for a more accurate recording of the ozone levels in the ACQR's.

Table H-1 AMBIENT AIR QUALITY STANDARDS

| Parameter | Standard<br>Primary | <br>Secondary |
|---|---|---|
| Particulate Matter: | | |
| Annual geometric mean | 75 ug/m$^3$ 1/ | 60 ug/m$^3$ |
| 24-hour maximum | 260 ug/m$^3$ | 150 ug/m$^3$ |
| Sulfur Oxides: | | |
| Annual arithmetic mean | 80 ug/m$^3$ | |
| 24-hour maximum | 365 ug/m$^3$ | |
| 3-hour maximum | -- | 1.300 ug/m$^3$ |
| Carbon Monoxide: | | |
| 8-hour maximum | 10 mg/m$^3$ 2/ | 10 mg/m$^3$ |
| 1-hour maximum | 40 mg/m$^3$ | 40 mg/m$^3$ |
| Photochemical Oxidants: | | |
| 1-hour maximum | 160 ug/m$^3$ | 160 ug/m$^3$ |
| Hydrocarbons: | | |
| 3-hour maximum | 160 ug/m$^3$ | 160 ug/m$^3$ |
| Nitrogen Dioxide: | | |
| Annual arithmetic mean | 100 ug/m$^3$ | 100 ug/m$^3$ |

1/ ug/m$^3$ = micrograms per cubic meter

2/ mg/m$^3$ = milligrams per cubic meter

Source: Air Quality Data - 1973 Third Quarter Statistics EPA, 1974.

Table H-2 STATE AMBIENT AIR QUALITY STANDARDS

| | Louisiana | Texas |
|---|---|---|
| Suspended Particulate Matter: | | |
| Annual geometric mean | $1^o$ | $1^o/11^o$ 1/ |
| Maximum 24-hour mean | $1^o$ | $1^o/11^o$ |
| Maximum consecutive 5-hour mean | ---- | 100 $ug/m^3$ (a) |
| Maximum consecutive 3-hour mean | ---- | 200 $ug/m^3$ (a) |
| Maximum consecutive 1-hour mean | ---- | 400 $ug/m^3$ (a) |
| Dustfall | 20 tons per square mile per month | ---- |
| Coefficient of Haze: | | |
| Annual geometric mean | 0.6 COH/1000 lin ft | ---- |
| Annual arithmetic mean | 0.75 COH/1000 lin ft | ---- |
| Maximum 24-hour mean | 1.50 COH/1000 lin ft | ---- |
| Sulfur Dioxide ($SO_2$): | | |
| Annual mean | $1^o$ | $1^o$ |
| Maximum 24-hour mean | $1^o$ | $1^o$ |
| Maximum 3-hour mean | ---- | $11^o$ |
| Maximum 30-minute mean | ---- | 0.4 ppm (b) (c) |
| Sulfuric Acid Mist: (Sulfur Trioxide, or any combination thereof) | | |
| Maximum annual mean | 4 $ug/m^3$ | ---- |
| 24-hour mean (not 1%) | 12 $ug/m^3$ | ---- |
| 1-hour mean (not 1%) | 30 $ug/m^3$ | ---- |
| Carbon Monoxide (CO) | $1^o$ | $1^o/11^o$ |
| Hydrocarbons (other than Methane) | $1^o$ | $1^o/11^o$ |
| Total Oxidants | $1^o$ | $1^o/11^o$ |
| Nitrogen Dioxide ($NO_2$) | $1^o$ | $1^o/11^o$ |

1/ $1^o$ and $11^o$ refer to the Primary and Secondary Federal Standards. (a) solid fossil fuel fired steam generators excepted; (b) 0.28 ppm (parts per million) for Harris and Galveston Counties; (c) 0.32 ppm for Jefferson and Orange Counties.

Source: Louisiana Air Quality Control Board, 1974. Texas Air Quality Control Board, 1974.

Table H-3 Air Pollution Emissions Estimates for the Louisiana Gulf Coastal Region

| Parish | Emissions in Tons/Year | | | | |
|---|---|---|---|---|---|
| | Nitrogen Oxides | Sulfur Oxides | Hydrocarbons | Carbon Monoxide | Particulate Matter |
| Ascension | --- | 12,330 | 13,200 | --- | 534,400 |
| Assumption | --- | 86 | 5,960 | --- | 4,360 |
| Calcasieu | --- | 57,380 | 55,100 | --- | 7,860 |
| Cameron | --- | 25 | 480 | --- | 38 |
| East Baton Rouge | --- | 35,200 | 118,300 | --- | 38,080 |
| West Baton Rouge | --- | 5,980 | 3,430 | --- | 2,690 |
| Iberia | --- | 4,760 | 24,800 | --- | 8,160 |
| Iberville | --- | 4,660 | 57,300 | --- | 2,690 |
| Jefferson | --- | 21,900 | 20,900 | --- | 6,470 |
| La Fourche | --- | 220 | 9,900 | --- | 4,790 |
| Lafayette | --- | 620 | 8,700 | --- | 2,460 |
| Livingston | --- | 110 | 1,930 | --- | 160 |
| Orleans | --- | 6,110 | 24,300 | --- | 7,260 |
| Plaquemines | --- | 20,800 | 5,780 | --- | 1,830 |
| St. Bernard | --- | 3,150 | 2,840 | --- | 680 |
| St. Charles | --- | 11,300 | 27,500 | --- | 2,330 |
| St. James | --- | 26,300 | 5,250 | --- | 25,700 |
| St. John the Baptist | --- | 2,170 | 3,420 | --- | 1,460 |
| St. Martin | --- | 150 | 3,870 | --- | 2,440 |
| St. Mary | --- | 5,340 | 82,400 | --- | 7,790 |
| St. Tammany | --- | 220 | 3,550 | --- | 5,850 |
| Tangipahoa | --- | 220 | 3,400 | --- | 750 |
| Terrebonne | --- | 220 | 9,140 | --- | 4,450 |
| Vermilion | --- | 140 | 1,890 | --- | 400 |

Source: Louisiana Control Commission: Louisiana Implementation Plan, 1972.

Table H-4 Air Pollution Emissions Estimates for the Texas Gulf Coastal Region

| | Emissions in Tons/Year | | | | |
|---|---|---|---|---|---|
| County | Nitrogen Oxides | Sulfur Oxides | Hydrocarbons | Carbon Monoxide | Particulate Matter |
| Aransas | | 247 | 5,010 | 120,660 | 340 |
| Brazoria | 4,395 | 8,124 | 116,658 | 169,006 | 3,930 |
| Calhoun | 1,375 | 263 | 23,209 | 258 | 9,313 |
| Cameron | | | 12,422 | 5,174 | 640 |
| Chambers | 70 | | 1,038 | 3,348 | 1,710 |
| Galveston | 2,558 | 10,643 | 65,167 | 114,128 | 6,712 |
| Harris | 11,962 | 119,473 | 156,058 | 436,418 | 57,727 |
| Jackson | | | 3,992 | | 420 |
| Jefferson | 6,449 | 71,370 | 130,366 | 326,603 | 11,368 |
| Kenedy | | | 685 | | |
| Kleberg | | | 7,616 | | 92 |
| Matagorda | 1,715 | 1 | 7,225 | 1,931 | 820 |
| Nueces | 244 | 2,274 | 49,736 | 156,423 | 4,838 |
| Orange | 1,505 | 4,267 | 24,157 | 79,212 | 5,360 |
| Refugio | | | 660 | | 179 |
| San Patricio | | 1,409 | 843 | 1 | 5,088 |
| Victoria | 1.930 | | 14,122 | 13,503 | 211 |
| Willacy | | | 199 | | 744 |

Source: Texas Air Control Board: Texas Implementation Plan, 1972.

Table H-5 1972 Emissions Inventory Summary -- for Air Quality Control Regions - Texas

| | Emissions in Tons/Year | | | | |
|---|---|---|---|---|---|
| AQCR | Particulates | Sulfur Oxides | Nitrogen Oxides | Hydrocarbons | Carbon Monoxide |
| 4 Brownsville | 8,245 | 5,747 | 36,214 | 52,451 | 141,650 |
| 5 Corpus Christi | 35,252 | 21,634 | 185,017 | 299,590 | 538,416 |
| 7 Houston-Galveston | 122,468 | 195,465 | 399,575 | 786,359 | 1,526,593 |

Table H-6

## SUMMARY OF AIR QUALITY CONTROL REGIONS (AQCR) EXCEEDING NATIONAL AMBIENT AIR QUALITY STANDARDS

Number of Occurrences When Levels Exceeded the Air Quality Standards

| | AQCR #106 1/ | | | AQCR #213 2/ | | | AQCR #214 3/ | | | AQCR #216 4/ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| POLLUTANTS | 1969 | 1970 | 1971 | 1969 | 1970 | 1971 | 1969 | 1970 | 1971 | 1969 | 1970 | 1971 |
| SULFUR DIOXIDE | | | | | | | | | | | | |
| Annual | | | | | | | | | | | | |
| No. greater than the secondary standard (60 ug/$m^3$ = 0.02 ppm) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| No. greater than the primary standard (80 ug/$m^3$ = ppm) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24-Hour Mean | | | | | | | | | | | | |
| No. greater than the secondary standard (260 ug/$m^3$ = 0.1 ppm) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| No. greater than the primary standard (365 ug/$m^3$ = 0.14 ppm) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3-Hour Mean | | | | | | | | | | | | |
| No. greater than the standard (ug/$m^3$ = 0.5 ppm) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## TABLE H-6 (continued) SUMMARY OF AIR QUALITY CONTROL REGIONS (ACQR) EXCEEDING NATIONAL AMBIENT AIR QUALITY STANDARDS

Number of Occurrences When Levels Exceeded the Air Quality Standards

| | AQCR #106[1] | | | AQCR #213[2] | | | AQCR #214[3] | | | AQCR #216[4] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| POLLUTANTS | 1969 | 1970 | 1971 | 1969 | 1970 | 1971 | 1969 | 1970 | 1971 | 1969 | 1970 | 1971 |
| SULFUR DIOXIDE | | | | | | | | | | | | |
| Annual | | | | | | | | | | | | |
| No. greater than the secondary standard (60 ug/m$^3$) | 4 | 4 | 2 | 1 | 3 | 0 | 0 | 1 | 0 | 4 | 3 | 2 |
| No. greater than the primary standard (75 ug/m$^3$) | 0 | 1 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 3 | 2 | 2 |
| 24-Hour Mean | | | | | | | | | | | | |
| No. greater than the sedondary standard (150 ug/m$^3$) | 0 | 0 | 0 | 2 | 3 | 3 | 0 | 0 | 0 | 1 | 1 | 8 |
| No. greater than the primary standard (260 ug/m$^3$) | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

TABLE H-6 (continued)

## SUMMARY OF AIR QUALITY CONTROL REGIONS (AQCR) EXCEEDING NATIONAL AMBIENT AIR QUALITY STANDARDS

### NUMBER OF OCCURRENCES WHEN LEVELS EXCEEDED THE AIR QUALITY STANDARDS

| | AQCR #106[1/] | | | AQCR #213[2/] | | | AQCR #214[3/] | | | AQCR #216[4/] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| POLLUTANTS | 1969 | 1970 | 1971 | 1969 | 1970 | 1971 | 1969 | 1970 | 1971 | 1969 | 1970 | 1971 |
| CARBON MONOXIDE | | | | | | | | | | | | |
| 1-hour standard | | | | | | | | | | | | |
| No. greater than the standard (40 mg/m$^3$ = 35 ppm) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8-hour standard | | | | | | | | | | | | |
| No. greater than the standard (10 mg/m$^3$ = 9 ppm) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| OXIDANTS | | | | | | | | | | | | |
| 1-hour standard | | | | | | | | | | | | |
| No. greater than the standard (160 ug/m$^3$ = 0.08 ppm) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

* Adapted from Table 309 (EPA, 1973).

ug/m$^3$ = micrograms per cubic meter.

mg/m$^3$ = milligrams per cubic meter.

ppm = parts per million (by volume).

[1/] Southern Louisiana - Southeast Texas (La.-Texas) (Includes Texas State Reg. 10)

[2/] Brownsville-Laredo (Texas) (Includes Texas State Region 4)

[3/] Corpus Christi-Victoria (Texas) (Includes Texas State Region 5)

[4/] Metropolitan Houston-Galveston (Texas) (Includes Texas State Region 7)

### TEXAS

Texas has a severe ozone problem. The standard doesn't allow the ozone level to exceed 0.08 parts per million (ppm) for more than one hour in a calendar year. The majority of the measurements have been made in the upper Gulf Coast area of Texas. This is the region where most of the petrochemical industries and metropolitan areas are concentrated.

Ozone concentration vary according to such things as: time of day, season, and weather conditions. During the sunlight hours and the sunny summer months the ozone level increases. Weather also plays a major role in ozone production. High winds usually keep ozone low while relatively stagnant air is conducive to high ozone levels.

The highest ozone level recorded in Texas was 0.42 ppm, measured in August of 1972 in Houston. In every major city in the state where the monitoring of ozone was conducted it showed a high and second high hourly value in excess of the standard of 0.08 ppm at one time or another in the year. However, in the 21,000 hours of monitoring only 700 recordings showed levels in excess of 0.08 ppm. This indicates the total ozone exposure experienced by Texans is low despite the occasionally high levels.

Following is a list of coastal area ozone summaries indicating the second highest ozone hours recorded to date at the various sites.

| *Location* | *Value (ppm)* |
|---|---|
| Houston | 0.256 |
| Olpine | .300 |
| Texas City | .234 |
| Clute | .155 |
| Nederland | .325 |
| West Orange | .195 |
| Corpus Christi | .184 |

Source: Texas Air Control Board, 1975

### Water Quality

The federal agencies responsible for water quality are the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers. The EPA has authority to issue permits for dredge disposal areas for marine water bodies. Unfortunately, almost all of the water quality data that has been collected by the Corps has not yet been quantified and is not available in a usable form. The EPA, now the primary federal pollution control agency, is presently issuing discharge permits to industries and municipalities and has begun to quantify the data through its Data Retrieval Program. The regional office for the Texas and Louisiana area is Dallas Texas (Region VI).

Texas has extensive data available for each water quality basin. Water quality management plans have been prepared in compliance to the 1972 amendments of the Federal Water Pollution Control Act (P.L. 92-500). These reports along with recent stream monitoring data show the actual quality of coastal streams and estuaries and are available from the Texas Water Quality Board.

The various agencies responsible for water pollution control in Texas and Louisiana are: Louisiana Wildlife and Fisheries Commission, Department of Pollution Control (industrial), and the Louisiana Department of Health, Bureau of Environmental Health (municipal); and Texas-Texas Water Quality Board and Texas Water Development Board.

At present, very little data is available from state sources for Louisiana. Most of the data available for this state pertains to point sources of pollution and amount of discharge.

Tables H-7 and H-8 summarize water pollution data for all coastal counties of Louisiana and Texas, including such parameters as BOD and TSS for both municipal and industrial sources. In all cases, the amount of discharge per county is expressed in millions of gallons per day (MGD). This figure is merely an expression of the amount of liquid water the discharges in each coastal county are contributing to the Gulf of Mexico or to streams leading to the Gulf. BOD (Biochemical Oxygen Demand) is a measure of the amount (in pounds per day per county) of dissolved oxygen (DO) consumed during the breakdown of organic matter in water by biological processes and organisms. TSS (total suspended solids) is simply an indication of the amount of solid, particulate matter suspended in water and is also measured here in pounds per day per county. Measurements of BOD and TSS are the most widely utilized parameters of water quality of a body of water. Water with excessive BOD and TSS amounts are considered to be polluted because of adverse effects to normally-occurring aquatic organisms.

As can be seen from Tables H-7 and H-8, the areas of heaviest water pollution are, of course, in major metropolitan areas of the coast, and, Table H-7 Municipal and Industrial Effluents for Louisiana Coastal Parishes

| Parish | Industrial M.G.D. 1/ | Municipal M.G.D. |
|---|---|---|
| Calcasieu | 419.2 | 10.7 |
| Cameron | 0.2 | 0.2 |
| Iberia | --- | 0.2 |
| Jefferson | 288.0 | 3.5 |
| La Fourche | 266.0 | --- |
| Orleans | 81.5 | 80.5 |
| Plaquemines | 161.0 | 3.0 |
| St. Bernard | 7.2 | 12.8 |
| St. Mary | --- | 4.1 |
| St. Tammany | --- | 1.3 |
| Terrebonne | 0.7 | 5.6 |
| Vermilion | --- | 1.2 |

1/M.G.D. - million gallons per day

Source: Cooperative Gulf of Mexico Estuarine Inventory and Study, Louisiana, 1971.

Table H-8 Municipal and Industrial Effluents for Texas Coastal Counties

| County | Industrial M.G.D. 1/ | Industrial B.O D. 2/ | Industrial T.S.S. 3/ | Municipal M.G.D. | Municipal B.O.D. | Municipal T.S.S. |
|---|---|---|---|---|---|---|
| Aransas | --- | --- | --- | 1.4 | 564 | 867 |
| Brazoria | 26.40 | 2,327 | 1,112 | 9.9 | 2,902 | 2,970 |
| Calhoun | 20.10 | 2,152 | 15,823 | 2.3 | 707 | 693 |
| Cameron | 88.10 | 2,636 | 20,678 | 15.2 | 8,705 | 8,243 |
| Chambers | 3.90 | 847 | 462 | .2 | 86 | 197 |
| Galveston | 125.20 | 112,767 | 300,620 | 15.0 | 16,283 | 11,257 |
| Harris | 336.00 | 554,260 | 555,831 | 197.4 | 75,443 | 128,721 |
| Jackson | --- | --- | --- | .7 | 130 | 166 |
| Jefferson | 210.00 | 183,174 | 130,801 | 66.0 | 23,258 | 12,575 |
| Kenedy | --- | --- | --- | --- | --- | --- |
| Kleberg | --- | --- | --- | 2.1 | 685 | 633 |
| Matagorda | 6.20 | 9,846 | 2,812 | 2.7 | 1,215 | 440 |
| Nueces | 197.00 | 65,106 | 76,935 | 28.5 | 11,825 | 5,980 |
| Orange | 130.20 | 151,395 | 91,919 | 7.3 | 4,345 | 1,406 |
| Refugio | .04 | 1 | 4 | 0.9 | 476 | 664 |
| San Patricio | 0.30 | 24 | 35 | 3.3 | 1,753 | 2,373 |
| Victoria | 35.80 | 6,755 | 13,010 | 3.9 | 951 | 3,078 |
| Wharton | 1.60 | 34 | 336 | 1.8 | 751 | 649 |
| Willacy | --- | --- | --- | 1.0 | 76 | 54 |

1/ M.G.D. = million gallons per day
2/ B.O.D. = biological oxygen demand, pounds per day
3/ T.S.S. = total suspended solids, pounds per day

Source: Texas Water Quality Board, Texas Water Development Board.

furthermore, in areas of concentrated petrochemical industries. Other less important sources of water pollution are fish oil processing plants, pulp and paper mills, and foundries and smelters. As might be expected, municipal pollution is a major source of pollution in several major metropolitan areas: Houston, New Orleans and Mobile.

## Historical and Projected Economic Growth

### Introduction

The areal extent of the industrial and economic effects that may result from this proposed sale are difficult to delineate, due to the fact that the Gulf of Mexico region is a major supplier of crude oil, petroleum products and natural gas to other regions of the United States. The following discussion is limited to the onshore areas adjacent to the proposed lease sale area since the initial economic effects may be assumed to impinge on these sectors.

Additional discussion of the economy in this assessment area has been published by the Bureau of Land Management in the following Final Environmental Impact Statements:

For the Texas area, OCS Sale No. 37 FES 74-63, Vol. 1, pp. 235-313 (USDI, 1975c).
For the Louisiana and Texas area, OCS Sale No. 38, FES 75-37, Vol. 1, pp. 149-212, (USDI, 1975a).
For the Gulf of Mexico region, OCS Sale No. 41, Vol. 1, pp. 309-364 (USDI, 1975b).

The coastal portion of Louisiana will be considered to be the central Gulf of Mexico region and the coastal area of Texas will be considered to be the western Gulf of Mexico region.

The historical changes that have occurred within the economies of these states are summarized in the following passages. These descriptions were based on statistical data provided in the Texas Almanac, 1974-1975 (1975), publications of the Research Department of the Federal Reserve Bank of Atlanta (1972) and supplemented by additional information relating to current economic conditions.

### LOUISIANA

Selected portions of the economic activity for Louisiana are presented in Table I-1. During 1970 approximately 40% of the manufacturing employment in southern Louisiana was in the durable goods industries, and approximately 60% of the employment in manufacturing was in the non-durable goods category.

Approximately 10% of the manufacturing employment in southern Louisiana during 1970 occurred in the metal industries, and almost 19% of the total manufacturing employment was in the category of chemicals and allied products.

Employment in retail trade in the city of New Orleans and including a portion of the adjacent area of the State of Mississippi, amounted to approximately 76,000 persons during 1967, and an additional 31,000 were employed in wholesale trade in the same area.

During October, 1975, the index of employment in manufacturing in Louisiana stood at 104.4 compared to 105.9 during the same period in October, 1974. Employment in the category of construction increased from an index of 99.7 during October, 1974, to 100.2 during October, 1975 (Federal Reserve Bank of Atlanta, 1975).

In the New Orleans Standard Metropolitan Statistical Area (SMSA) including Orleans, Jefferson, St. Bernard, and St. Tammany parishes, the civilian labor force during the month of December, 1975, amounted to 425,500 persons, compared to 418,400 persons during December, 1974. During December, 1975, employment amounted to 391,300 persons, an increase of 4,900 persons over the same month the previous year. However, comparing the unemployment for December, 1975, with December, 1974, reveals that unemployment also increased. During December, 1975, 34,200 persons were classified as unemployed, an increase of 2,200 over the 32,000 persons classified as unemployed during December, 1974.

### TEXAS

Selected portions of the economic activity for Texas are presented in Table I-2.

During October, 1975, approximately 443,000 workers were employed in the manufacture of durable goods, and approximately 365,000 were employed in manufacturing non-durable goods below the levels of October, 1974 in both categories.

Employment in wholesale and retail trade amounted to approximately 951,000 persons in 1972. Employment in water transportation amounted to approximately 21,000, and employment in pipeline transportation amounted to approximately 5,000 during 1972.

The recent changes in the economy of the State of Texas have been summarized by Stockton (1975a).

Comparison of business activity in Texas with measures of business activity on the national level indicated that the Texas economy has shown much greater resistance to the depressing forces present within the national economy than has the nation as a whole. However, the Texas economy did not maintain a normal growth rate.

The most depressed segment of the Texas economy has been the building industry. For the first nine months of 1975 the amount of residential construction declined four percent from the same period in 1974, and residential construction during 1974 was 21 percent below 1973.

Non-residential construction authorizations continue to trail 1974 authorizations in value, but this gap is also narrowing. Major non-residential building categories with increases of 1974 levels include office buildings, hospitals and other institutional structures, and works and utilities.

Employment in the construction industry in Texas amounted to 6.29 percent of the total non-agricultural employment within the state during September, 1975, and ranged from approximately six to 10 percent in selected metropolitan areas (Zlatkovich, 1975).

Employment data is one source of information or change in the individual sectors of the economy although they tend to be rather slow to reflect changes. The changes from a month earlier are not very significant, but employment in durable goods industries declined five percent from a year ago. The decline was rather general, oil field machinery representing the only substantial increase. In non-manufacturing industries, oil and gas extraction showed an increase of seven percent, but contract construction was down six percent. Employment in retail trade rose two percent and in finance, insurance, and real estate rose three percent (Stockton, 1975b).

The percentages of unemployed persons reported from selected locations along the Texas coast during the month of October, 1975, are summarized in Table I-3.

The influence of the increased level of petroleum exploration activity both within the state and in other areas, was reflected in various sectors of the Texas economy. Employment in machinery manufacture (excluding electrical) was eight percent higher in February, 1975, than in February, 1974, reflecting largely the increase of 17.5% in employment in oil field machinery manufacture. This is the result of the recent increase in oil exploration. Employment in the manufacture of instruments and related products, which also reflects the effects of oil exploration, increased 5.1% over the past year (Stockton, 1975a).

Employment within Texas in activities related to the oil and gas production and processing industries has also been affected during the past year.

Crude oil production in February, 1975, decreased seven percent compared with February, 1974, as the Texas fields have apparently reached their full capacity for the present. But higher prices of crude oil can be expected to continue; they will undoubtedly support exploration and will add substantially to the economy. Texas employment in oil and gas extraction in February, 1975, showed an increase of 10.5% over the February, 1974 figure, in spite of the fact that the total production of crude oil declined over the same period. The decline in gasoline consumption over the past year is reflected in the 15.1% decline of employment in refining. Some of the decline in refining has been offset by increased activity in chemicals, which are mainly petrochemicals. In spite of the decline in refining, oil and gas continue to be among the major supporting factors for the Texas economy (Stockton, 1975a).

### Population and Employment

In 1972, the U.S. Water Resources Council published the 1972 OBERS (Office of Business Economics-Economic Research Service) projections of economic activity in the United States. These projections consist of historical and projected data incorporating population, employment and income and earnings information classified by state and by region. The 1972 projections utilized population projections published by the United States Census Bureau, and were based on the Series C fertility rates. Recently, the projections of economic activity in the various OBERS Economic Areas based on the Series E fertility rates have become available. Projections based on Series E forecast a lower level of population in future years. The following projections for BEA (Bureau of Economic Analysis) areas located within Louisiana and Texas were obtained from the Series E projections.

In considering the coastal portions of Louisiana and Texas during the period 1950 to 1970 the percentage increase in population and employment in these states was greater than the percentage increase in national population and employment. During the period 1970 to 1990, population and employment in the western Gulf of Mexico region is expected to increase at a greater percentage rate than the national percentage rate.

Tables I-4 & I-5 contain population, employment and per capita income data; both historical and projected, for the BEA areas included within Louisiana and Texas.

Table I-1 Economic Activity for Louisiana

| | 1963 | 1972 | |
|---|---|---|---|
| Per capita personal income | $1,764 | $ 3,543 | |
| Total personal income | $5,901 | $13,179 | (million) |
| Total cash farm income | $ 488 | $ 882 | (million) |
| Cash farm receipts from crops | $ 264 | $ 507 | (million) |
| Cash farm receipts from livestock and products | $ 164 | $ 324 | (million) |
| Petroleum production | 477 | 896 | (mil. bbls.) |
| Value of construction | $ 659 | $ 2,036 | (million) |
| Manufacturing employment | 139 | 179 | (thousand) |
| Construction employment | 53 | 85 | (thousand) |

Source: Statistics on the Developing South Federal Reserve Bank of Atlanta - May 1972 and Supplements

Table I-2 Economic Activity in Texas

| | 1962 | 1972 | |
|---|---|---|---|
| Per capita personal income | $ 2,027 | $ 4,045 | |
| Total personal income | $20,518 | $47,121 | (million) |
| Total cash farm income | $ 2,575 | $ 3,722[1] | (million) |
| Cash farm receipts from crops | $ 1,352 | $ 1,132 | (million) |
| Cash farm receitps from livestock and products | $ 1,075 | $ 2,122 | (million) |
| Petroleum production | 943 | 1,301[2] | (mil. bbls.) |
| Value of construction | 1,132 | 1,751[1] | |
| Manufacturing employment | 497 | 741 | (thousand) |
| Construction employment | --- | 238 | (thousand) |

Source: Texas Almanac 1975-1975. A. H. Belo Corporation

[1] 1971

[2] Crude production appears to have peaked during 1974.

Table I - 3 Percentages of Unemployed Persons from Selected Texas Coastal Areas

| Location | Percent Unemployed October, 1975 | Percent Increase From October, 1974 |
|---|---|---|
| Beaumont-Port Arthur-Orange | 9.1 | 78 |
| Brownsville-Harlingen-San Benito | 10.2 | 19 |
| Corpus Christi | 7.3 | 22 |
| Galveston-Texas City | 5.9 | 40 |
| Houston | 5.1 | 34 |

Source: Texas Business Review, December, 1975

Table I-4

## Regional Population and Employment

| Region | 1950 | 1970 | Percent Change 1950-1970 | 1990 | Percent Change 1970-1990 |
|---|---|---|---|---|---|
| Central Gulf BEA Areas: 138 and 139 | | | | | |
| Population | 2,070,014 | 2,900,230 | 40.1 | 3,142,900 | 8.4 |
| Employment | 692,826 | 963,028 | 39.0 | 1,186,500 | 23.2 |
| Western Gulf BEA Areas: 140, 141, 142, 143 & 144 | | | | | |
| Population | 3,140,093 | 4,883,064 | 55.5 | 6,078,000 | 24.5 |
| Employment | 1,133,386 | 1,816,283 | 60.3 | 2,535,700 | 39.6 |
| United States | | | | | |
| Population | 151,325,798 | 203,235,298 | 34.3 | 246,039,000 | 20.7 |
| Employment | 57,474,912 | 79,306,527 | 38.0 | 106,388,000 | 34.1 |

Source: OBERS 1972 E Projections

## Table I-5 Population, Employment, and Per Capita Income, Historical and Projected 1950-2000

## 1972-E, OBERS Projections, Bureau of Economic Analysis

| BEA | Economic Area | 1950 | 1970 | Percent Change 1950-1970 | 1980 | 1990 | 2000 |
|---|---|---|---|---|---|---|---|
| 138 | New Orleans, La. | | | | | | |
| | Population | 1,535,505 | 2,149,598 | 40.0% | 2,284,200 | 2,440,000 | 2,528,600 |
| | Per Capita Income | 1,641 | 2,849 | 73.6% | 3,900 | 5,200 | 7,000 |
| | Total Employment | 530,342 | 717,945 | 35.4% | 854,000 | 928,900 | 1,012,500 |
| 139 | Lake Charles, La. | | | | | | |
| | Population | 534,509 | 750,632 | 40.4% | 695,800 | 702,900 | 685,400 |
| | Per Capita Income | 1,256 | 2,463 | 96.1% | 3,400 | 4,500 | 6,200 |
| | Total Employment | 162,484 | 245,083 | 50.8% | 251,400 | 257,600 | 263,800 |
| 140 | Beaumont-Port Arthur-Orange, Texas | | | | | | |
| | Population | 299,857 | 396,723 | 32.3% | 432,800 | 484,900 | 520,100 |
| | Per Capita Income | 1,820 | 3,105 | 70.6% | 4,200 | 5,500 | 7,400 |
| | Total Employment | 106,986 | 140,677 | 31.5% | 168,800 | 192,300 | 215,800 |
| 141 | Houston, Texas | | | | | | |
| | Population | 1,257,035 | 2,374,842 | 88.9% | 2,832,400 | 3,362,700 | 3,780,400 |
| | Per Capita Income | 2,308 | 3,519 | 52.5% | 4,700 | 6,100 | 8,000 |
| | Total Employment | 485,199 | 945,995 | 95.0% | 1,244,700 | 1,474,400 | 1,701,900 |

(continued)

Table I-5 (continued) Population, Employment, and Per Capita Income, Historical and Projected 1950-2000
1972-E, OBERS Projections, Bureau of Economic Analysis

| BEA | Economic Area | 1950 | 1970 | Percent Change 1950-1970 | 1980 | 1990 | 2000 |
|---|---|---|---|---|---|---|---|
| 142 | San Antonio, Texas | | | | | | |
| | Population | 853,013 | 1,235,581 | 44.8% | 1,245,900 | 1,352,000 | 1,417,200 |
| | Per Capita Income | 1,674 | 2,770 | 65.5% | 3,800 | 5,000 | 6,800 |
| | Total Employment | 309,559 | 451,412 | 45.8% | 503,500 | 550,300 | 598,300 |
| 143 | Corpus Christi, Texas | | | | | | |
| | Population | 407,011 | 518,920 | 27.5% | 515,000 | 534,600 | 544,000 |
| | Per Capita Income | 1,525 | 2,651 | 73.8% | 3,700 | 4,800 | 6,600 |
| | Total Employment | 132,095 | 176,319 | 33.5% | 195,100 | 204,300 | 217,400 |
| 144 | McAllen-Pharr-Edinburg, Texas | | | | | | |
| | Population | 323,177 | 356,998 | 10.5% | 346,000 | 343,800 | 336,300 |
| | Per Capita Income | 1,111 | 1,884 | 69.6% | 2,800 | 3,700 | 5,200 |
| | Total Employment | 99,547 | 101,880 | 2.3% | 113,800 | 114,400 | 118,100 |

1/ Per Capita Income is expressed in 1967 dollars.

The coastal portion of Louisiana and part of Mississippi, comprising the central Gulf of Mexico region, is included with BEA economic areas 138 and 139.

The coastal portions of Texas are included within BEA areas 140, 141, 143 and 144, and are included within the western Gulf of Mexico region.

A comparison of the population, employment and personal income of the inhabitants of these regions with the total United States population, employment and personal income is shown in Table I-6.

Perhaps the most significant relationship revealed in Table I-6 is that in both regions employment and personal income is a smaller percentage of national employment and personal income than is the percentage of population of the total U.S. population.

A significant trend that has been present during the last decade in the economic climate of Louisiana and Texas has been the decline in farm employment and the increase in employment in manufacturing and such non-manufacturing categories as mining, construction, transportation and services.

Table I-7, based on data obtained from the 1972-E OBERS projections, presents the earnings data for selected industries in the Gulf of Mexico regions during 1970.

The BEA economic regions included within classification of western and central Gulf of Mexico form only a portion of the various states bordering the Gulf of Mexico.

**Agriculture**

During the year 1950, 7,047,625 persons were employed in agriculture in the United States. By the year 1970, 2,813,971 persons were employed in agriculture, and the projected employment in the year 1990 amounted to 2,003,000 persons. The total earnings from agriculture amounted to 19.3 billions of 1967 dollars during 1970, and are projected to amount to 22.6 billions of 1967 dollars in 1990, Table I-8. These projections were contained in the 1972 OBERS projections (U.S. Water Resources Council, 1974) based on the Series E population projections developed by the Bureau of the Census, USDC, 1970. The OBERS projections do not reflect the current energy problem, changes in agricultural exports, or changes in conservation and environmental activities.

The total value of agricultural products within Louisiana and Texas was projected to increase during the period 1959 to 1980, according to the OBERS projections (Table I-9). The total land in farms was projected to decrease in these states during the same period of time. The decrease noted in the total land in farms was in accord with the projection for the entire United States (Table I-10).

During the period 1962 to 1972, the total workers on Texas farms decreased from 415,000 in 1962 to 275,000 in 1972. The total workers include both family workers and hired workers. The total number of family workers decreased from 243,000 to 187,000 and the number of hired workers decreased from 172,000 to 88,000 (A. H. Belo Co., 1973).

These changes in employment reflect post-war changes in Texas agriculture, also reflected in the increase in the average size of Texas farms and increases in the average value of land and buildings on farms and ranches.

The most notable change has been the mechanization of farming due to the increasing use of tractors, mechanical harvesters and other machinery in place of human and animal labor. The introduction and adoption of agricultural chemicals, improved plants and animals, irrigation and increased availability of off-the-farm services have been significant factors in the change of Texas agriculture.

The pattern of decreasing farm employment was also evident in the other states bordering the Gulf of Mexico.

**The Petroleum Industry in the Gulf of Mexico Region**

Some further discussion of the petroleum industry of Louisiana and Texas is appropriate, since crude petroleum and natural gas production developed as a result of exploration and production activity on the outer continental shelf will probably be a source of raw material for initial processing within the coastal portions of these states.

The production of oil and gas may be classified as a primary industry; the further processing of oil and gas in refineries, gasoline, and petrochemical plants may be considered as secondary industries; and the increased development of tertiary industries may be expected to develop as a result of the economic activity undertaken by the primary and secondary industries.

Table I-6 Population and Employment By Income Regions Compared to Total U. S., 1970

| | Total U. S. | Gulf of Mexico<br>Central | <br>Western |
|---|---|---|---|
| Total Population | 203,857,864 | 2,900,230 | 4,883,064 |
| Percent of U. S. | --- | 1.4 | 2.4 |
| Total Employment | 79,306,527 | 963,028 | 1,816,283 |
| Percent of U. S. | --- | 1.2 | 2.3 |
| Total Personal Income[1] | $708,583,931 | $7,973,192 | $15,059,700 |
| Percent of U. S. | --- | 1.1 | 2.1 |

[1] Total personal income in thousands of 1967 dollars.

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Table I-7 Total Earnings[1] by Selected Industries, 1970

| Industry | Total U. S. | Gulf of Mexico<br>Central | <br>Western |
|---|---|---|---|
| Agriculture, forest & fisheries | 19,640,721 | 226,622 | 408,029 |
| Mining | 5,647,503 | 407,977 | 448,490 |
| Manufacturing | 156,291,199 | 1,137,201 | 2,415,108 |
| Services | 85,077,671 | 884,246 | 1,792,200 |
| Government | 99,310,475 | 1,073,445 | 2,350,310 |

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[1] Total earnings in thousands; 1967 dollars

Source: OBERS Projections, Series E.

Table I-8 Total Earnings from Agriculture (thousands of 1967 dollars)

| | 1969 | 1980 |
|---|---|---|
| Central Gulf of Mexico | | |
| BEA 138 | D1/ | 118,400 |
| BEA 139 | D | 137,900 |
| Total Central Gulf | D | 256,300 |
| Western Gulf of Mexico | | |
| BEA 140 | 4,440 | 4,100 |
| BEA 141 | D | 94,000 |
| BEA 142 | 127,549 | 119,100 |
| BEA 143 | 87,322 | 81,400 |
| BEA 144 | D | 96,100 |
| Total Western Gulf | 219,311 (partial) | 394,700 |

1/ Deleted

Source: OBERS Projections, Series E, Population

Table I-9 Value of Agricultural Production (shown in 1967 dollars)

| State | 1959 | 1980 |
|---|---|---|
| Louisiana | | |
| Total crops | 246,071.4 | 428,392.0 |
| Total livestock | 171,141.9 | 276,147.3 |
| Total state | 417,213.3 | 704,539.3 |
| Texas | | |
| Total crops | 1,071,387.1 | 1,368,388.7 |
| Total livestock | 949,329.8 | 1,479,583.5 |
| Total state | 2,020,716.8 | 2,847,972.2 |

Table I-10. Land in Farms (thousand acres)

| | 1959 | 1980 |
|---|---|---|
| United States | | |
| Cropland, harvested | 311,285.2 | 292,242.6 |
| Cropland, not harvested | 136,278.5 | 165,843.4 |
| Forest and woodland | 163,684.3 | 105,231.8 |
| Pasture, range, other | 508,909.8 | 481,566.3 |
| Total land in farms | 1,120,157.8 | 1,044,884.1 |
| Louisiana | | |
| Cropland, harvested | 2,425.9 | 3,747.5 |
| Cropland, not harvested | 2,481.1 | 2,351.7 |
| Forest and woodland | 3,212.9 | 1,634.0 |
| Pasture, range, other | 2,227.4 | 1,868.6 |
| Total land in farms | 10,347.3 | 9,601.8 |
| Texas | | |
| Cropland, harvested | 22,236.5 | 20,331.0 |
| Cropland, not harvested | 13,362.6 | 19,273.8 |
| Forest and woodland | 13,631.1 | 8,624.0 |
| Pasture, range, other | 93,987.1 | 93,338.5 |
| Total land in farms | 143,217.5 | 141,617.3 |

Source: OBERS Projections, Series E

The coastal region of the states bordering the Gulf, including both onshore and offshore areas, have been producing oil and gas for many years. The production of these hydrocarbons has led to the extensive development of a system of production, transportation, refining and other manufacturing facilities based on the availability of crude and refined petroleum products in the region.

Oil and gas resources include substances classified as crude oil, condensate, natural gas and natural gas liquids. Crude oil is a mixture of hydrocarbons that exists as a liquid in the natural underground reservoir and continues to exist as a liquid on the surface at atmospheric pressure. Condensate is a substance that exists as a gas in the natural underground reservoir and exists as a liquid under atmospheric conditions. Natural gas plant liquids are hydrocarbons extracted from streams of natural gas processed at plants. The American Petroleum Institute and American Gas Association statistical data include as crude oil, small amounts of hydrocarbons recovered from oil well gas that exist as gases in the reservoir but become liquid at atmospheric pressure. All other liquids including condensate are reported as natural gas liquids.

### HISTORICAL DATA OF GULF OF MEXICO OCS OPERATIONS

Although gas well footage drilled offshore increased 43.3% in the lst quarter of 1975 over the same quarter last year, the exploratory gas well footage declined 11.5% Table I-11). This decline was offset by the increase of 48.2% in developmental gas well footage. Almost three-fourths of the offshore exploratory drilling in the 1st quarter of 1975 took place off Texas, but over 95% of the offshore developmental gas footage occurred off the Louisiana coast.

The number of acres held under active lease in the Gulf of Mexico has increased from 2 million hectares in 1969 to 3 million hectares as of March 31, 1975. Approximately 41% of the acreage held on March 31, 1975, was classified as included in producing leases, compared to 58% so classified in 1968.

The amounts of oil, condensate and gas that have been produced from Federal leases in the Gulf of Mexico are published in Outer Continental Shelf Statistics (USGS, 1975).

The amounts of oil and gas produced from these leases in Louisiana and Texas are tabulated in Table I-12.

### CRUDE OIL, GAS LIQUIDS AND NATURAL GAS RESERVES

The estimates of crude oil, gas liquids and natural gas reserves of the two-state area adjacent to the Gulf of Mexico as of January 1, 1974, are presented in Table I-13.

### CRUDE PETROLEUM PRODUCTION

During the year 1974, approximately 62% of the total U.S. production of crude petroleum occurred in the states of Louisiana and Texas.

The quantities produced in the coastal area of Louisiana and Texas are shown in Table I-l4.

A significant fact revealed by these statistics is a decline in the production of crude oil and condensate in this region. These decreases occurred in spite of an increase in the average value per barrel of oil.

Recent production figures (Table I-15) indicate that the decline in offshore production was evident during the first nine months of 1975 (U.S. Department of the Interior, 1975b).

### NATURAL GAS

The Minerals Yearbook (U.S. Department of the Interior, 1973b), provides statistical detail concerning the source and use of natural gas.

Natural gas produced in Texas during 1971 was used to satisfy the demand for gas by individuals and organizations within Texas and in other areas of the United States. During the year 1971, natural gas was also imported from, and exported to Mexico. Some volumes of natural gas produced in other states were transported into Texas during the year.

Approximately 90% of the natural gas withdrawn from Texas wells was marketed. The balance was used for repressuring and a small amount was vented to the atmosphere or flared. The marketed production of Texas natural gas, augmented by volumes obtained from other areas, was delivered to interstate pipelines for transmission to other areas, consumed in Texas or added to storage. Some amounts of gas were lost in transmission. Approximately 51% of the total Texas receipts of natural gas were consumed in Texas.

Some of this gas was used for lease and plant fuel and pipeline fuel, but approximately 72% was delivered to consumers, including residential and commercial users, electric utilities and industrial establishments. The industrial uses of the natural gas included fuel for refining operations, feed-

Table I-11 NEW WELL AND COMPLETION DATA ON THE FEDERAL OCS, GULF OF MEXICO

| Year | Oil & Gas New Well Starts | Oil & Gas Well Completions | Zone Completions Producible Oil and Gas Zones Oil | Gas | Total |
|---|---|---|---|---|---|
| 1968 | 931 | 410 | 524 | 166 | 690 |
| 1969 | 826 | 363 | 448 | 125 | 573 |
| 1970 | 827 | 535 | 611 | 266 | 877 |
| 1971 | 806 | 379 | 357 | 240 | 597 |
| 1972 | 839 | 335 | 303 | 180 | 483 |
| 1973 | 816 | 418 | 302 | 288 | 590 |
| 1974 | 808 | 305 | 221 | 155 | 376 |

Source: Federal Power Commission News, August 8, 1975.

Table I-12 OIL AND CONDENSATE (thousand bbls)

| Year | Louisiana | Texas | Total |
|---|---|---|---|
| 1968 | 263,825 | 3,111 | 266,936 |
| 1969 | 300,159 | 2,760 | 302,919 |
| 1970 | 333,411 | 2,247 | 335,658 |
| 1971 | 385,760 | 1,685 | 387,445 |
| 1972 | 387,591 | 1,733 | 389,324 |
| 1973 | 374,197 | 1,618 | 375,815 |
| 1974 | 342,435 | 1,382 | 343,817 |

NATURAL GAS MMCF

| Year | Louisiana | Texas | Total |
|---|---|---|---|
| 1968 | 1,413,468 | 109,911 | 1,523,379 |
| 1969 | 1,822,544 | 127,097 | 1,949,641 |
| 1970 | 2,273,147 | 133,300 | 2,406,447 |
| 1971 | 2,634,014 | 127,358 | 2,761,372 |
| 1972 | 2,881,365 | 147,156 | 3,028,521 |
| 1973 | 3,055,628 | 148,674 | 3,204,302 |
| 1974 | 3,349,171 | 159,979 | 3,509,150 |

Source: Outer Continental Shelf Statistics, U.S.G.S
June, 1975

Table I-13 ESTIMATED CRUDE OIL, NATURAL GAS LIQUIDS AND NATURAL GAS RESERVES 1/

| State | Crude Oil Thousands of Barrels | Natural Gas Liquids Thousands of Barrels | Natural Gas MMCF |
|---|---|---|---|
| Louisiana | 4,576,826 | 1,992,537 | 69,151,613 |
| Texas | 11,756,613 | 2,830,143 | 84,936,502 |

1/ These totals represent approximately 48, 76 and 62 percent, respectively of the total U.S. reserves as of January 1, 1974.

Source: American Petroleum Institute, et al. (1975), estimates as of January 1, 1974.

Table I-14 Production, Producing Wells and Average Production Per Well

| | 1974 | 1973 |
|---|---|---|
| Louisiana (Gulf Coast) | | |
| Crude Petroleum Production 1/ | 698,488 | 791,760 |
| No. Producing Oil Wells | 12,858 | 13,086 |
| Average Production Per Well 2/ | 147.5 | 162.4 |
| Average Value Per Barrel | $6.52 | $4.00 |
| Texas (Gulf Coast) | | |
| Crude Petroleum Production | 246,586 | 253,296 |
| No. Producing Oil Wells | 14,257 | 14,199 |
| Average Production Per Well | 47.5 | 46.6 |
| Average Value Per Barrel | $7.41 | $4.11 |
| United States (Total) | | |
| Crude Petroleum Production | 3,202,585 | 3,360,903 |
| No. Producing Oil Wells | 497,631 | 497,378 |
| Average Production Per Well | 17.6 | 18.3 |
| Average Value Per Barrel | $6.74 | $3.89 |

---

1/ Thousands of barrels
2/ Average production per well per day (barrels)

Source: U. S. Department of the Interior (1975a).

Table I-15 Crude Oil and Condensate Production for Texas and Louisiana Offshore Areas (thousands of bbls.)

| | 1972 | 1973 | Jan-Sept. 1975 | Jan-Sept. 1974 |
|---|---|---|---|---|
| Louisiana Gulf Coast | | | | |
| Offshore | | | | |
| State | 78,693 | 53,298 | 29,920 | 57,972 |
| Federal | 318,423 | 373,486 | 241,160 | 249,773 |
| Total Offshore | 397,116 | 426,784 | 271,080 | 307,745 |
| Texas Gulf Coast | | | | |
| Offshore | | | | |
| State | 577 | 669 | 251 | 457 |
| Federal | 504 | 728 | 318 | 385 |
| Total Offshore | 1,981 | 1,397 | 569 | 842 |

Source: U. S. Department of the Interior, 1975c.

stock for the chemical industry and as material for the manufacture of carbon black.

During the year 1974 the total marketed production of natural gas in the United States amounted to 21,600 billion cubic feet (612 billion cubic meters), a decrease percentage from the 1973 level. The marketed production in the states of Louisiana and Texas amounted to 15,924 billion cubic feet, (451 billion cubic meters), approximately 74 percent of the total marketed production, Table I-16.

Net deliveries of natural gas to interstate pipelines during 1974 amounted to approximately 5,526 billion cubic feet (157 billion cubic meters) from Louisiana and 3,229 billion cubic feet (91 billion cubic meters) from Texas. Consumption of natural gas in Louisiana and Texas amounted to approximately 7,115 billion cubic feet (202 billion cubic meters) during 1974, approximately 32% of the total U.S. consumption during the year (USDI, 1974g).

The number of producing and condensate wells located in these states decreased from 34,356 to 33,894 between December 1973 to 1974.

The Federal Power Commission News, (1973), in a review of aspects of the natural gas supply in the United States, remarked on the recovery of gas well drilling activity that began in 1972 and continued during 1973 until capacity bottlenecks occurred toward the end of the year. The review continued an analysis of the current supply situation. "In contrast, the shortage of gas supply for ultimate consumers became more acute during 1973. On June 18, 1976, the Federal Power Commission released a staff report which indicated that curtailments in natural gas deliveries by major interstate natural gas pipeline companies for the 12 month period April 1976 through March 1977 will be more than 3.6 trillion cubic feet compared to an actual curtailment of 2.8 trillion cubic feet for the year April 1975 through March 1976. The term curtailment means the difference between the amounts of gas a pipleine is required to deliver, by contract or otherwise, and the amounts it is actually able to deliver.

The report shows the estimated curtailment to be 25% of total requirements. Thus, pipelines project they will only be able to deliver 75% of the gas they are committed to deliver, as opposed to the approximately 80% they were able to deliver last year.

### EMPLOYMENT IN OFFSHORE PETROLEUM ACTIVITIES

The Department of Commerce publications, 1972 Census of Mineral Industries, provide data on mining operations concerned with the extraction of solids, liquids, and gases.

For oil and gas field operation and contract services, reports were required for units somewhat different from the "establishment" reporting unit used for other types of mining. Every concern which operated oil and gas wells or performed oil and gas field services for others during any part of calendar year 1972 was required to submit a separate report for each state, or offshore area adacent to a state.

Industries were classified in accord with the definitions established in the 1972 Standard Industrial Classified Manual. This system developed over a period of years by experts from government and private industry under the guidance of the Office of Management and Budget.

Industry 131, Crude Petroleum and Natural Gas, represents establishments primarily engaged in operating oil and gas field properties. Such activities include exploration for crude petroleum and natural gas; drilling, completing, and equipping wells; operation of separators, emulsion breakers, desalting equipment; and all other activities incident to making oil and gas marketable up to the point of shipment from the producing property. The data published for this industry include figures for administrative offices, warehouses, storage facilities, and other auxiliary units which service mining industries. For the crude petroleum and natural gas industries, details were obtained on the type of wells drilled and operated and reports were classified on the basis of whether or not they drilled wells. No drilling data or wells-operated data were obtained or estimated for companies with less than five paid employees. While these small companies account for a small percentage of value added in the oil and gas industry, they do engage in significant drilling activity and they also operate a large number of wells.

SIC Industry Group 138, Oil and Gas Field Services, includes three principal industries. Industry 1381, Drilling Oil and Gas Wells, represents establishments primarily engaged in drilling wells for oil or gas for others on a contract, fee or other basis. This industry includes contractors that specialize in spudding in, drilling in,

Table I-16 Natural Gas Production and Consumption (million cubic feet)

| | 1973 | 1974 |
|---|---|---|
| Gross Withdrawals | | |
| Louisiana | 8,491,194 | 7,919,810 |
| Texas | 9,289,945 | 8,170,798 |
| Total | 17,781,139 | 16,090,608 |
| Marketed Production | | |
| Louisiana | 8,242,423 | 7,753,631 |
| Texas | 8,513,850 | 8,170,798 |
| Total | 16,756,273 | 15,924,429 |
| Consumption | | |
| Louisiana | 2,216,692 | 2,202,693 |
| Texas | 5,087,521 | 4,912,481 |
| Total | 7,304,213 | 7,115,174 |
| Net Deliveries to Interstate Pipelines | | |
| Louisiana | 5,905,857 | 5,526,285 |
| Texas | 3,390,531 | 3,742,066 |
| Total | 9,296,388 | 8,755,922 |

Source: U. S. Department of the Interior (1974g).

redrilling, and directional drilling. Industry 1382, Oil and Gas Exploration Services, represents establishments primarily engaged in geophysical, geological, and other exploration work on a contract, fee or other basis.

Industry 1389, Oil and Gas Field Services, N.E.C. represents establishments primarily engaged in performing for others on a contract, fee, or other basis, such oil and gas field services as excavating, grading and building foundations, surveying, well cementing, well treating, and running, cutting, and pulling casing, tubes and rods.

SIC Industry Group 132, Natural Gas Liquids, represents establishments primarily engaged in producing liquid hydrocarbons from oil and gas field gases. Establishments recovering liquified petroleum gases incident to petroleum refining or to the manufacturing of chemicals are classified in Major Groups 28 or 29, are therefore not included within this group.

Data published in the applicable volumes of the 1972 Census of Mineral Industries reveal the historical changes in establishments, employees and payrolls in these industrial categories in the United States, Table I-17.

During the year 1972, the number of employees within SIC 138 were further classified into membership within SIC 1381, Drilling Oil and Gas Wells; SIC 1382, Oil and Gas Exploration Services, and SIC 1389, Oil and Gas Field Services NEC.

Table I-18 provides a summary of the employment within the oil and gas exploration and production related industries during the year 1972.

During the year 1972, the total of all employees included within the U.S. total number of employees amounted to 240,500 persons. The total number of employees classified as working on offshore activities was 14,400 persons, approximately six percent of the total national employment in these industry groups. The total employment associated with the Louisiana offshore amounted to 11,900 persons, approximately five percent of the total national employment and 83 percent of the total national offshore employment.

Comparison of offshore employment levels between 1967 and 1972 for the West South Central Division includes the offshore areas adjacent to the states of Texas and Louisiana, Table I-19.

### Petroleum Refining and Petrochemical in the Coastal Zone

On January 1, 1975, the crude oil capacity of the operating petroleum refineries in the United States amounted to 14,980,550 barrels per calendar day (BCD). The total operating refinery capacity in the refineries along the coast of Texas and Louisiana amounted to 5,117,950 BCD or approximately 34% of the total U.S. capacity, Table I-20.

Additional crude oil refining capacity amounting to 615,550 BCD was under construction in the coastal areas of Louisiana and Texas.

#### PETROLEUM REFINING INDUSTRY OF TEXAS

As of January 1, 1974, according to the annual refining survey published in the Oil and Gas Journal (January 1, 1974), there were 24 operating petroleum refineries in the Texas coastal region with a combined capacity of more than three million barrels per calendar day.

The Texas Gulf coast refining district is the largest domestic refining district, measured in crude oil throughout capacity, and accounted for approximately 23% of the total operating crude oil throughout capacity of the United States (including Puerto Rico) (USDI, 1973f).

During the period 1962 to 1973, the daily crude oil capacity in the Texas Gulf coast district increased by 846,400 BCD, an increase of approximately 39% over the 1962 operating capacity. The raw material received at refineries in the Texas Gulf coast refining district includes crude oil from domestic and foreign sources, natural gas liquids and other hydrocarbons. The products produced by refineries include gasoline and other fuels, lubricating oils, wax, coke, asphalt and feedstocks for petrochemical plants.

Refineries in Texas receive crude oil from other states for processing and some of the crude oil produced in Texas is shipped to other states for refining.

During the year 1973, a total of 1,174 billion barrels were received at refineries in Texas. Approximately 1,045 billion barrels were obtained from sources within the United States, and an additional 128.8 million barrels were obtained from foreign sources. This level of imports is approximately equal to 350,000 BCD, (USDI, 1974).

#### PETROCHEMICAL INDUSTRY

The importance of the chemical industry to Texas was recently evaluated by Ryan (1973).

Table I-17 Exploration and Production Employees - 1972

| Year | SIC 1311 | SIC 1321 | SIC 138 |
|---|---|---|---|
| | Number of Employees (thousands) | | |
| 1954 | 172.5 | 17.3 | 125.9 |
| 1958 | 180.1 | 16.5 | 116.3 |
| 1963 | 145.2 | 13.9 | 112.4 |
| 1967 | 126.4 | 12.4 | 106.4 |
| 1972 | 116.6 | 10.7 | 113.2 |
| | Number of Establishments | | |
| 1954 | 11,508 | 562 | 5,515 |
| 1958 | 12,010 | 593 | 5,915 |
| 1963 | 14,378 | 652 | 6,212 |
| 1967 | 8,796 | 684 | 6,878 |
| 1972 | 7,605 | 680 | 6,209 |
| | Payroll (millions of dollars) | | |
| 1954 | 835.7 | 85.1 | 541.6 |
| 1958 | 1,043.1 | 96.3 | 561.3 |
| 1963 | 1,016.4 | 96.6 | 631.7 |
| 1967 | 1,049.1 | 99.5 | 706.5 |
| 1972 | 1,376.0 | 116.8 | 1,032.9 |

Source: Census of Mineral Industries (1972)
Bureau of the Census

## Table I-18 Employees in Offshore Operations

### All Employees (thousands) 1972

| Industry | Total U.S. | Total Offshore | West South Central Region | Total Louisiana | Louisiana Offshore | Total Texas | Texas Offshore | Other Offshore California | Other Offshore Alaska |
|---|---|---|---|---|---|---|---|---|---|
| 131 - 1311 | 116.6 | 5.3 | 77.7 | 20.0 | 4.0 | 46.7 | 0.3 | 0.7 | 0.3 |
| 132 - 1321 | 10.7 | N.D. | 8.1 | 1.7 | N.D. | 5.1 | N.D. | N.D. | N.D. |
| 138 - 1381 | 45.2 | 5.1 | 29.3 | 11.4 | 4.6 | 13.7 | 0.5 | N.D. | N.D. |
| 138 - 1382 | 9.8 | 0.2 | 5.7 | 0.8 | 0.1 | 4.2 | N.D. | N.D. | N.D. |
| 138 - 1389 | 58.2 | 3.8 | 40.1 | 12.3 | 3.2 | 18.7 | N.D. | N.D. | N.D. |

### Production, Development and Exploration Workers (thousands) 1972

| Industry | Total U.S. | Total Offshore | West South Central Region | Total Louisiana | Louisiana Offshore | Total Texas | Texas Offshore | Other Offshore California | Other Offshore Alaska |
|---|---|---|---|---|---|---|---|---|---|
| 131 - 1311 | 51.9 | 3.7 | 30.8 | 9.5 | 3.0 | 16.1 | 0.2 | 0.4 | 0.1 |
| 132 - 1321 | 8.9 | N.D. | 7.0 | 1.4 | N.D. | 4.5 | N.D. | N.D. | N.D. |
| 138 - 1381 | 40.1 | 4.5 | 25.6 | 10.0 | 4.0 | 11.9 | 0.5 | N.D. | N.D. |
| 138 - 1382 | 7.8 | 0.1 | 4.3 | 0.7 | 0.1 | 3.1 | N.D. | N.D. | N.D. |
| 138 - 1389 | 45.5 | 3.2 | 31.0 | 10.0 | 2.7 | 15.1 | N.D. | N.D. | N.D. |

Note: N.D. means No Data.

Industry 1311 - Primarily engaged in operating oil and gas field properties.

Industry 1321 - Primarily engaged in producing liquid hydrocarbons from oil and gas field gases.

Industry 1381 - Primarily engaged in drilling oil or gas wells for others on a contract, fee, or similar basis.

Industry 1382 - Primarily engaged in performing geophysical, geological and other exploration services on contract or fee.

Industry 1389 - Primarily engaged in performing miscellaneous oil and gas field services.

Table I-19 Number of Employees (thousands)
West South Central Division

| Industry | 1972 | 1967 |
|---|---|---|
| 131 - 1311 | 4.3 | 2.3 |
| 132 - 1321 | N.D. | N.D. |
| 138 - 1381 | 5.1 | 4.4 |
| 138 - 1382 | 0.1 | 0.4 |
| 138 - 1389 | 3.2 | 2.1 |

Source: Census of Mineral Industries (1972)
Bureau of the Census

Table I-20 LOUISIANA COASTAL OIL REFINERIES

| Operating Refineries | Location | Crude Oil Capacity B/CD |
|---|---|---|
| Canal Refining | Church Point | 3,750 |
| Cities Service | Lake Charles | 268,000 |
| Continental Oil | Egan | 15,000 |
| Continental Oil | Westlake | 83,000 |
| Evangeline Refining | Jennings | 4,600 |
| Exxon | Baton Rouge | 445,000 |
| Good Hope Refineries | Good Hope | 29,450 |
| Gulf Oil | Belle Chase | 180,400 |
| Gulf Oil | Venice | 28,700 |
| La Jet | St. James | 11,000 |
| Murphy | Mereaux | 92,500 |
| Placid Refining | Port Allen | 36,000 |
| Shell | Norco | 240,000 |
| Tenneco | Chalmette | 103,000 |
| Texaco | Convent | 140,000 |
| Total Operating | | 1,680,400 |
| **Capacity Additions under Constructions** | | |
| Exxon | Baton Rouge | 15,000 |
| Good Hope Refineries | Good Hope | 20,050 |
| | | 35,050 |
| **Refineries under Construction** | | |
| ECOL, Ltd. | Reserve | 200,000 |
| Total Capacity under Construction | | 235,050 |

| Texas Coastal Refineries Operating | | Crude Oil Capacity Barrels/Cal. Day |
|---|---|---|
| American Petrofina of Texas | Port Arthur | 84,000 |
| Amoco Oil Co. | Texas City | 333,000 |
| Atlantic Richfield Co. | Houston | 213,000 |
| Champlin Petrolemu Co. | Corpus Christi | 67,700 |
| Charter International Oil Company | Houston | 70,000 |
| Coastal States Petrochemical Co. | Corpus Christi | 185,000 |
| Crown Central Petroleum Corp. | Pasadena | 100,000 |
| Eddy Refining | Houston | 3,250 |
| Exxon co. | Baytown | 400,000 |
| Gulf Oil Corp. | Port Arthur | 312,100 |
| Marathon Oil Co. | Texas City | 64,000 |
| Mobil Oil | Beaumont | 335,000 |
| Monsanto Chemical | Alvin | 8,500 |
| Phillips Petroleum | Sweeney | 85,000 |
| Quintana-Howell | Corpus Christi | 30,000 |
| Shell Oil Co. | Deer Park | 294,000 |
| Total Operating and Under Construction | | 1,915,450 |
| South Hampton Co. | Silsbee | 18,100 |
| Southwestern Refining Co. | Corpus Christi | 114,000 |

Table I-20 (continued)

| | | |
|---|---|---|
| Sun Oil Co. | Corpus Christi | 57,000 |
| Texaco | Port Arthur | 406,000 |
| Texaco | Port Neches | 47,000 |
| Texas City Refining | Texas City | 74,500 |
| Union Oil Co. of California | Nederland | 127,000 |
| Union Texas Petroleum | Winnie | 9,400 |
| | | 3,437,550 |

Texas Coastal Refineries
Capacity Additions (under construction)

| | | |
|---|---|---|
| American Petrofina of Texas | Port Arthur | 34,000 |
| Atlantic Richfield Co. | Houston | 92,000 |
| Exxon Company | Baytown | 250,000 |
| Mid-Tex Refinery | Hearne | 4,500 |
| | | 380,500 |

Total Capacity (Operating and Under Construction)-3,818,050

Louisiana and Texas Totals

| State | No. of Refineries | Crude Oil Capacity (B/CD) |
|---|---|---|
| Louisiana (coastal area) | | |
| Operating | 15 | 1,680,400 |
| Under Construction | 1 | 235,050 |
| Total | | 1,915,450 |
| Texas (coastal area) | | |
| Operating | 24 | 3,437,550 |
| Under Construction | - | 380,500 |
| Total | 24 | 3,818,050 |
| Texas and Louisiana Totals | | |
| Operating | 39 | 5,117,950 |
| Under Construction | 1 | 615,550 |
| Total | 40 | 5,733,500 |

Source: Petroleum Refineries Annual
Bureau of Mines
January 1, 1975

Chemical production is Texas' top-ranking industry as measured by value added by manufacture (the difference between the cost of raw materials and the value of products). In 1973, more than 61,000 workers were employed in chemical plants; the output value in 1970 totaled $4.8 billion. The most important product group is industrial organic chemicals, the basic materials from which synthetic fibers and plastics, rubber, lubricants and hundreds of other products are made.

Late in the year 1972, a survey revealed that 622 petrochemical plants were operating within the United States. Of this total number of plants, approximately 22% were located in Texas. More than two-thirds of the plants representing almost 90% of the producing capacity were located in the coastal zone of Texas. During the period 1950-59; 21 plants commenced operations; during the period 1960-69; 17 plants went on stream.

The most important reason cited for the growth of the petrochemical industry in Texas is "nearness to raw materials". Other factors influencing the development of this industry have included the availability of an existing facility; the availability of transportation, labor and land, and nearness to markets.

### PETROLEUM RELATED INDUSTRIES IN LOUISIANA

The following description of some of the important industries in the Louisiana coastal zone was published in the Louisiana Advisory Commission on Coastal and Marine Resources (1973a). The following description of the more important industries in the coastal zone parishes by the Louisiana Department of Commerce and Industry was presented in a report to the Commission in February, 1972.

Industry in the coastal region is dominated by petroleum refining, petrochemical production, ship and boat building, food processing and primary metals. Apparel making, metal fabrication, and pulp and papermaking are also important industries. Petroleum refining and petrochemicals are by far the largest. More than $5 billion has been invested in these industries in the coastal region since World War II and most of these 32,000 plus workers employed in these industries work in the coastal parishes. There are approximately 100 major petroleum and petrochemical plants in Louisiana making the state one of the principal producers in the United States. A number of the facilities are among the largest of their kind in the world. Over the last 10 years Louisiana has attracted about 10% of all new investment in chemical and petroleum refining expenditures in this country.

Ship and boat building continue to be a mainstay in the state's industrial economy. A shipyard is the single largest employer in Louisiana, with a work force ranging upward to 10,000 at times. The Avondale yards and other smaller yards specialize in supplying the needs of the offshore oil and gas industry with drilling platforms, tugs, barges, crewboats and other specialized vessels that are constructed in Louisiana. Boats for commercial fishing and pleasure use are built in small yards scattered across the coastal region.

Specific areas within Louisiana with important concentrations of refineries and petrochemical plants include Baton Rouge, New Orleans and Lake Charles. The Lower Mississippi Region Comprehensive Study includes descriptions and projections for significant economic and industrial factors. Water Resource Planning Area (WRPA) includes 10 Louisiana parishes and Amite County, Mississippi, and includes the Baton Rouge area. An economic description of this area emphasizes the importance of the Baton Rouge industrial development.

Baton Rouge, the capital of Louisiana, is a major center of petroleum and chemical industries. It is situated on the Mississippi River 322 km from the Gulf of Mexico at the head of navigation for ocean-going vessels. The total value of industrial investment along the banks of the Mississippi River in WRPA 8 since 1946, has been $1.9 billion ($0.6 billion between 1946 and 1960, and $1.3 billion between 1961 and 1971). In 1967, East Baton Rouge Parish accounted for 81% of the area's $564.1 million value added by manufacturing. Petroleum refineries, the industrial base of the city, are supplied by nearby oil fields in south Louisiana. Many plants in the city either supply refinery needs, further process refinery products, or are engaged in related work.

Water Resource Planning Area 9 included a 14 parish area extending from the border with Texas to the basin of the Atchafalaya River, bordering the Gulf of Mexico. WRPA 9 is rich in oil, natural gas, salt, sulfur, sand, gravel and clays. The development of oil and natural gas resources has contributed more than any other factor to the progress of the area and to the rapid strides made in the raising of living standards and industrial growth. Oil and gas fields are located throughout the area as well as offshore in the Gulf of Mexico. Salt deposits are located on the eastern and western borders and sulfur is mined in Calcasieu Parish.

A combination of varied natural resources, water access, geographical location, road and rail connections has made WRPA 9 an attractive location for industrial firms. The extent and quality of these resources are attested to by some of the Nation's major chemical producers having developed a multi-million-dollar petrochemical complex around Lake Charles. Natural resources have also been of great importance to Lafayette, Louisiana, as it has become the area headquarters and service center for the oil and gas industry. Industrial growth has also been enhanced by the existence of the deepwater port of Lake Charles.

Water Resource Planning Area 10 includes Jefferson, Orleans, St. Bernard and St. Tammany parishes. Due to the presence of varied natural resources and its location on crossroads of internal and foreign commerce, WRPA 10 has experienced remarkable industrial development. A vast complex of petrochemical plants has been developed in recent years along the Mississippi River. Other industries have grown up around such native resources as sulfur, salt, sugar and imported products such as bauxite, gypsum and coffee have also contributed to industrial development.

### TRANSPORATION OF OIL AND PRODUCTS

During 1974, refineries in Texas and Louisiana received crude oil from producing wells in the same state as the refinery location, from producing wells in other states and imported crude oil from foreign nations, Table I-21.

Pipeline transportation is important in providing means for the delivery of crude petroleum to refineries in the four state area.

Table I-21

### TRANSPORTATION OF CRUDE OIL IN 1974
(thousands of barrles)

| Area | Pipelines | Tank Cars & Trucks | Tankers & Barges |
|---|---|---|---|
| **Louisiana** | | | |
| Domestic crude | 415,079 | 5,084 | 96,370 |
| Foreign crude | --- | --- | 16,510 |
| **Texas** | | | |
| Domestic crude | 920,773 | 9,619 | 115,054 |
| Foreign crude | --- | --- | 128,872 |
| Total | 1,335,852 | 14,703 | 211,424 Domestic crude<br>145,382 Foreign crude |

Source: United States Department of the Interior, 1974i.

## Future Environment Without the Proposal

It is important that the future environment of the Gulf of Mexico be examined in the event that the proposal does not occur.

The addition of the oil and gas produced as a result of this sale to the quantities of oil and gas currently being produced on the outer continental shelf in the Gulf of Mexico can be expected to continue the use of facilities installed for the transportation and processing of oil and gas reserves developed from previous state and federal offshore lease sales.

Production developed in onshore areas prior to, concurrent with and subsequent to production developed in the offshore areas also required production, transportation and processing facilities. In the event that this proposed sale was not held, it is considered probable that the skilled and unskilled labor, specialized equipment and other facilities that would be employed in the development of leases awarded as a result of proposed Sale 44 would be employed in the specialized activity of exploring for, producing, processing and transporting oil and gas in an alternate area.

The resultant economic and environmental impact of these activities in other areas can not be known at this time, as it would be necessary to delineate these areas in a precise fashion in order to estimate these impacts. It is possible that the resources would be employed in the onshore areas adjacent to the offshore areas; in which case, the economic impact would be similar to the impact anticipated to result from this proposed sale

Given the extensive development of industries supporting the offshore production of oil and gas, and the extensive development of industries related to the processing of oil and gas, additional supplies of oil and gas from any source in the Gulf of Mexico area are likely to be processed within existing facilities in the area.

It is probable that industry interest in the OCS indicates that larger quantities of oil and gas may be obtained for a given investment dollar. If this speculation is valid, it suggests that outer continental shelf production is efficient in the economic sense, in that a larger return can be anticipated from a smaller expenditure of scarce resources.

A further observation governing the continued operation of the refining industry, and industries utilizing the products of refineries may be in order. It is probable that existing refineries within the Gulf of Mexico coastal area will continue to operate as long as demand for the products continue. In the event that sufficient feed stock is not available, imported crude oils will be utilized. According to the Federal Energy Administration (1975) imports of crude oil amounted to approximately 3.9 million barrels per day, compared to domestic production of an estimated 8.5 million barrels per day during December, 1974.

The environmental effects of additional onshore production, and/or additional crude oil imports to the existing refining centers, must be considered in determining the status of the future environment of the Gulf of Mexico region in the event that this proposed lease sale is not implemented.

# ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

Much of the impact data on which this section was based, was generalized, incomplete and not specific to the Gulf of Mexico. In many cases, impact estimates were determined by extrapolating from such data. Where such data was reasonably sufficient, the magnitude and importance of such impacts have been identified. However, no attempt was made to make conclusive and quantified impact estimates if the data base was considered inconclusive. Such impacts were discussed generally and speculatively.

## Basic Assumptions Regarding Causes of Impacts of the Proposed Action

Should development follow this proposed sale, it will impact the natural and socioeconomic environments of the Gulf of Mexico area. To identify impacts and assess their magnitude and significance, it is necessary to project certain basic assumptions as follows:

### Disposal of Cleaned Drill Cuttings and Commercial Muds

Drill cuttings are composed of shattered and pulverized sediments and underlying native rock. Drill cuttings range from about 1170 cubic meters for a 3,048 meter well to about 2,202 cubic meters for a 5,486 meter well. (Otteman, Personal Communication.)

The first 46± meters of a well will be drilled or jetted with seawater. The resulting seawater mud will be returned directly to the sea floor without being pumped to the rig. While drilling the hole to 305 meters, typically only seawater will be used as drilling fluid; and it will be discharged overboard. If the formation clays do not make a viscous enough mud, some natural bentonitic clay will be added to the system. The discharged water amounts to approximately 7,000 barrels, and it will contain mostly natural mud generated while drilling the hole. Before running the conductor pipe to 305 meters, approximately two tons of bentonite clay will be added to the 1,000-barrel saltwater system. When the conductor pipe is cemented, this volume of bentonite clay in seawater will be discharged overboard.

While drilling the remainder of the hole, the mud is continuously cycled back through the mud system. Some mud is discharged with the drill cuttings; and periodically, drilling mud is discharged overboard to make room for natural mud made while drilling the hole. This periodic discharge averages 500 barrels a day; therefore, during approximately 20 days of drilling to 3,098 meters, some 10,000 barrels of bentonite clay and lignosulfonate treated mud would be discharged overboard.

The common components of the drilling mud which will be discharged are identified in Table A-1. This discussion is based on the representative well-drilling mud program, but other components could be added in special cases. Some 28,750 to 86,250 tons of commercial drill muds will be used in drilling this number of wells (USGS, 1976).

Present mud technology does require that mud be disposed in order to change the characteristics or chemistry necessary for changing conditions as a well is drilled deeper (USGS, 1976). If there is any mud left over from one well, it can be reused in the following well.

However, when the muds are no longer suited for re-use or when the well has been completed and it is not considered economical to return muds to shore they are discharged into the marine environment. When these muds are introduced into the marine environment this discharge must comply with the OCS operating orders. The drilling mud may be discharged (1) with the drill cuttings; (2) when cleaning shale or sand tanks (settling tanks); (3) while drilling the upper portion of the hole prior to establishing circulation to the drilling platform; and (4) upon disconnection of a marine riser. The last two cases apply only to operations from floating drilling platforms and not to jack-up or fixed production platforms.

If we assume 25 to 75 exploratory wells and 100 to 300 production wells with an average depth of 3,048 meters in the proposed sale area, then 146,230 to 438,689 cubic meters of cuttings will be disposed.

Of some concern is the presence of chromium in some marine drilling muds such as the organic complex (ferro) chrome lignosulfonate. Overboard loss or discharge of drilling fluids would introduce some of this chromium into the marine environment. Overall recent industrial tendencies toward maximum recovery of chemical additives minimize any potential hazard to marine life.

Barite is used as a weighing agent to control formation pressures while drilling in the mid to bottom portions of the hole. Chromium lignosulfonates are thinners which are placed into a mud system for control of viscosity, gel strength, and

## TABLE A-1

## Components of Drilling Muds Which Are Normally Discharged into the Sea

| Substance | Source | Use | Composition | Known Hazard |
|---|---|---|---|---|
| Attapulgite clay | Quarry | To cause gelling of salt water based muds | A light green magnesium-rich clay, quarried as "Fuller Earth" | NONE |
| Bentonite clay | Quarry | To cause gelling of freshwater based muds | A light-colored montmorillonitic clay; slippery sticky when wet; swells to 10-20 times its dry volume | NONE |
| Caustic soda | Electrolysis of sodium chloride brine | For pH control | Sodium hydroxide, NaOH | Corrosive in concentrated form; not harmful after mixing into mud at low concentration and allowed to react |
| Ferrochrome lignosulfonate | Digestion of wood by sulfonate process removal of cellulose; reaction with chromium compounds | Dispersant and emulsifier | Ferrochrome salt of lignosulfonic acid; content: Fe-2.6%, Cr-3.0%, S-5.5% | Possible chromium toxicity in pure form, none known from diluted form in muds |
| Organic polymer | Chemical process with plant starch, wood fiber as raw materials | Conditioner, texturizer | Starch, cellulosic derivatives | NONE |

TABLE A-1 (continued)

Components of Drilling Muds Which Are Normally Discharged into the Sea

| Substance | Source | Use | Composition | Known Hazard |
|---|---|---|---|---|
| Proprietary defoamer | Soap making process | Defoamer | Aluminum stearate $Al[Ch_3(Ch_2)16]3$ | NONE |
| Barite | Mined as the mineral | Weighing agent | Barium sulfate $Ba\ SO_4$ | It is recommended that public water supplies contain no more than 1 mg/l barium |
| Gypsum (Plaster of Paris) | Mined as the mineral | Flocculantand calcium source | Calcium sulfate $CaSQ_4.2\ H_2O$ | Potentially hazardous |
| Tennin | Extracted from the Quebracho tree | Thinning agent | Complex organic compound, $5(C_{14}H_9O_9).C_6H_7O$ | NONE |
| Carboxymethyl cellulose | From stalks and stems of plants | Fluid loss agent | Complex organic polymer | Potentially hazardous |
| Sodium acid pyrophosphate | Reaction of sodium with pyrophosphoric acid | Thinning agent | $Na_2H_2P_2O_7$ | NONE |
| Siderite | Mined as the mineral | Weighing agent | $FeCO_3$ | NONE |

TABLE A-1 (continued)

Components of Drilling Muds Which Are Normally Discharged into the Sea

| Substance | Source | Use | Composition | Known Hazard |
|---|---|---|---|---|
| Formaldehyde | Oxidation of methanol | Bactericide | HCHO | Potentially hazardous |
| Penta | Reaction of hexachlorobenzene with sodium hydroxide | Bactericide | $C_6CI_5OH$ | Potentially hazardous |
| Potassium | Mined as the mineral sylvite in carnallite | Flocculant | Potassium chloride<br>KCl | NONE |
| Sodium bicarbonate | Passils carbon dioxide thru a solution of normal carbonate | Precipitate soluble calcium, pH control | $NaHCO_3$ | NONE |

Source: Rogers (1963), Robichaux (1975), Land (1974), USDI (1975) filtrate loss. They are also introduced into the mud system while drilling from the mid to bottom portions of the hole. There is strong environmental concern about products containing barium and chromium due to the possibility of the release into the environment of the toxic $Ba^{+2}$ and hexavalent $Cr^{+6}$ ions.

Barite has been used in the Gulf of Mexico drilling mud programs since the inception of drilling in 1947. The data from several investigations have shown barite to be essentially non-toxic to marine organisms. The threshold of $LC_{50}$ of the barite was found to be greater than 7500 ppm. The concern that the $Ba^{+2}$ ion will be released from barite seems to be unfounded. Barium sulfate has a very low solubility ranging from 0.000246 to 0.000413 gms/100 cc of freshwater. Also, barium sulfate is a non-toxic insoluble salt that is used as an opaque medium in radiography. Investigative results and the physical properties of barium sulfate classify it as a low to non-toxic compound. As long as barium remains in compounds having very low solubilities, it is considered non-toxic. If alteration to soluble forms occurs under certain circumstances in the marine environment, toxicity could be a matter for concern. Presently, the existence or non-existence of such alteration mechanisms is unknown.

The modified lignosulfonates (chromium and ferrochromiums) are prepared by the dichromate oxidation of sulfite pulp lignosulfonate liquor. This reaction firmly chelates the chromium so that it may not be removed from the lignosulfonate complex even by strong ion-exchange resins. Further studies show the chromium ion to be in a trivalent state which may interact with the planar surface of bentonite clays by a base-exchange mechanism. These results would indicate that the trivalent chromium ion added to the drilling mud, in the form of a modified lignosulfonate, is strongly associated with either the lignosulfonate or bentonite clay and as such does not enter into additional reactions. The Gulf Universities Research Consortium (GURC, 1974) reported that results from concentrations in Timbalier Bay in the Gulf of Mexico indicated that toxic metals (barium and chromium) presented no evidence of biological hazard and are below levels promulgated as being harmful to the biota. The values reported for chromium from the Offshore Ecology Investigation data are within the ranges reported for other oceanic waters.

Bioassay studies have shown chrome-lignosulfonate to have a 96-hour TLM in salt water of 12,200 ppm and a 96-hour $TL_{50}$ of 465 ppm. In a study of drilling fluids used in the Canadian Arctic, a concentration gradient of Cr in undiluted mud discharges ranged from 0.3 ppm at the top of the hole to 24.8 ppm at TD. Once on the seafloor, chromelignosulfonate is fairly resistant to biodegradation; however, certain benthic invertebrates are known to concentrate trace amounts of various heavy metals over extended time. The possible role of drilling mud chromium additives in this phenomenon is the subject of ongoing research.

Occasionally, abnormal formation pressures, exceptionally tight formations or other problems require the use of oil-base mud or highly treated drilling muds. Drill cuttings are then separated and cleaned of entrained oil before being discharged overboard, and the drilling muds are retained and shipped to shore and stored in tanks for future use.

### Discharge of Produced Formation Waters

Table A-2 presents a representative list of components for three offshore brines for the Louisiana region. Due to the stratification of oilfield brines within a given formation and/or seepage between reservoirs, the chemical and physical properties of the waters may change during the period of oil production.

Under the Federal Water Pollution Control Act of 1972, OCS Order No. 7, (Appendix B), and EPA effluent limitations (1975), the design of formation and other waste water disposal systems will limit the oil content of discharged effluent to a maximum of 72 mg/l for any one day, and a thirty consecutive day average not to exceed 48 mg/l (BPCTCA). A maximum of 52 mg/l, for any one day, and a thirty consecutive day average not to exceed 30 mg/l (BATEA and New Source), assuming more stringent regulations are not in effect. Further assuming that all formation water is discharged (worst case), from 2200 to 2800 barrels of oil per year will be introduced into the marine environment. Over the 25-year anticipated production period, from 55,000 to 70,000 barrels will be introduced.

The Environmental Protection Agency has developed a ''Development Document for Interim Final Effluent Limitations Guidelines and New Source Performance Standards for the Oil and

## Table A-2 CHEMICAL CONTENT OF REPRESENTATIVE OFFSHORE BRINES [1/]

### Offshore Louisiana

| Component | | High Solids | | Average Solids | | Low Solids | |
|---|---|---|---|---|---|---|---|
| | | mg/l [2/] | % | mg/l | % | mg/l | % |
| Iron | FE | 153 | 0.057 | 15 | 0.011 | 139 | 0.226 |
| Calcium | Ca | 17,000 | 6.287 | 4,675 | 3.294 | 772 | 1.254 |
| Magnesium | Mg | 2,090 | 0.773 | 1,030 | 0.726 | 152 | 0.247 |
| Sodium | $Na^+$ | 84,500 | 31.250 | 49,120 | 34.612 | 22,651 | 36.800 |
| Bicarbonate | $HCO_3$ | 37 | 0.014 | 100 | 0.070 | 933 | 1.516 |
| Sulfate | $SO_4^=$ | 120 | 0.044 | 0 | 0 | 188 | 0.305 |
| Chloride | $Cl^-$ | 166,500 | 61.575 | 86,975 | 61.287 | 36,717 | 59.652 |
| Total Solids | | 270,400 | 100% | 141,915 | 100% | 61,552 | 100% |

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[1/] From U. S. Geological Survey, Oil and Gas Supervisor, Gulf of Mexico Area. New Orleans, Louisiana (1975).

[2/] mg/l is equivalent to part per million.

Gas Extraction Point Source Category''. This document proposes the utilization of ''best available'' technology to achieve a ''no discharge'' goal by 1983. This document was published in the Federal Register Vol. 40, No. 179, September 15, 1975. We have not assumed a ''no discharge'' rate, but if it is in effect then the 2,800 barrels may be substantially lower.

Depending on the physical and chemical properties of the formation waters as well as receiving waters, it is anticipated that the brines will become well mixed in the water column within a few days of discharge. The impacts resulting from the anoxic formation water are therefore expected to be short-term (actual time dependent upon mixing/dilution rates) and localized.

### Disruption of Sea Floor and Resuspension of Sediments During Pipeline Burial

During pipeline burial, large volumes of sediment are disrupted and resuspended for a short time in overlying waters. As the width of the trench varies with the compactness and fluidization point of sediment, we can only estimate the volume of disturbed sediments. If the trench is roughly two meters deep by two to four meters wide, and a parabolic cross-section is assumed, pipeline burial would disturb approximately 1,400 to 3,800 cubic meters per km, some of which would be resuspended. While we have estimated 161 km of marine pipelines, some portions may not be buried; i.e., those sections in water deeper than 61 meters where burial may not be required; sections of the gathering system around groups of platforms may not require burial; and sections in state waters where the Department of the Interior has no jurisdiction and cannot require burial.

### Placement of Temporary and Permanent Offshore and Onshore Platforms, Pipelines and Terminal Facilities

It is estimated that a maximum of two onshore terminal/storage facilities may be constructed as a result of this proposed sale. Each facility will require approximately 16 hectares of land. Approximately 20 to 40 offshore platforms will be required as a result of this proposed sale.

### Probability of Accidental Oil Spills in the Gulf of Mexico

The most important feature of oil spill statistics as reported by CEQ (1974) is the size of individual spills which range from a fraction of a barrel to over 15,000 barrels. Most spills are at the low end of this range; in 1972, 96% of spills were less than 24 barrels (1,000 gallons) and 85% were less than 2.4 barrels (100 gallons). A few very large spills account for most of the oil spilled (the Torrey Canyon accident of 1967 spilled twice as much oil as was reported spilled in the United States in 1970). In 1970 and 1972, three spills each year accounted for two-thirds of all oil spilled in the United States in those years. Because amounts spilled per incident can vary by a factor of one million, it is meaningless to estimate ''average'' amounts of oil that might be spilled during development. Data supplied by the Geological Survey for the period of 1964-1976 (only first quarter of 1976) indicate a total of 54 oil spill incidents connected with Federal OCS oil and gas and condensate, and one spill greater than 50 barrels in the California OCS.

The estimated total volume of oil spilled during this period as a result of these incidents is slightly more than 300,000 barrels (12.6 million gallons). A distribution of these 54 Gulf incidents as to type and amount spilled is presented in Figure A-1.

#### PIPELINE ACCIDENTS

Since new regulations concerning pipelines went into effect in 1970, the spillage rate has been 0.0017% of total production. At this rate, assuming 11 million barrels of oil per year will be transported by pipeline to onshore and offshore terminals, 187 barrels of oil per year could be spilled as a result of pipeline malfunctions. As indicated in Figure A-1, the severing of pipelines by ships' anchors causes the release of the greatest quantity of oil into the world's oceans.

#### OIL AND/OR GAS WELL BLOWOUTS DURING DRILLING

Imminent blowouts may be controlled by increasing mud weight and activating blowout preventers. If these control systems fail, the well being drilled may blow out of control. Quantities of drill mud, cuttings, sediment, and some oil and gas may be released to the marine environment. If a producing oil well blows out, large quantities of oil and gas may be released into the marine environment; and, if a producing gas well blows out, escaping gas either burns or disperses into the atmosphere.

Outer continental shelf statistics indicate that one blowout occurs for every 2,860 wells drilled. An average of 2,100 barrels of oil is spilled for

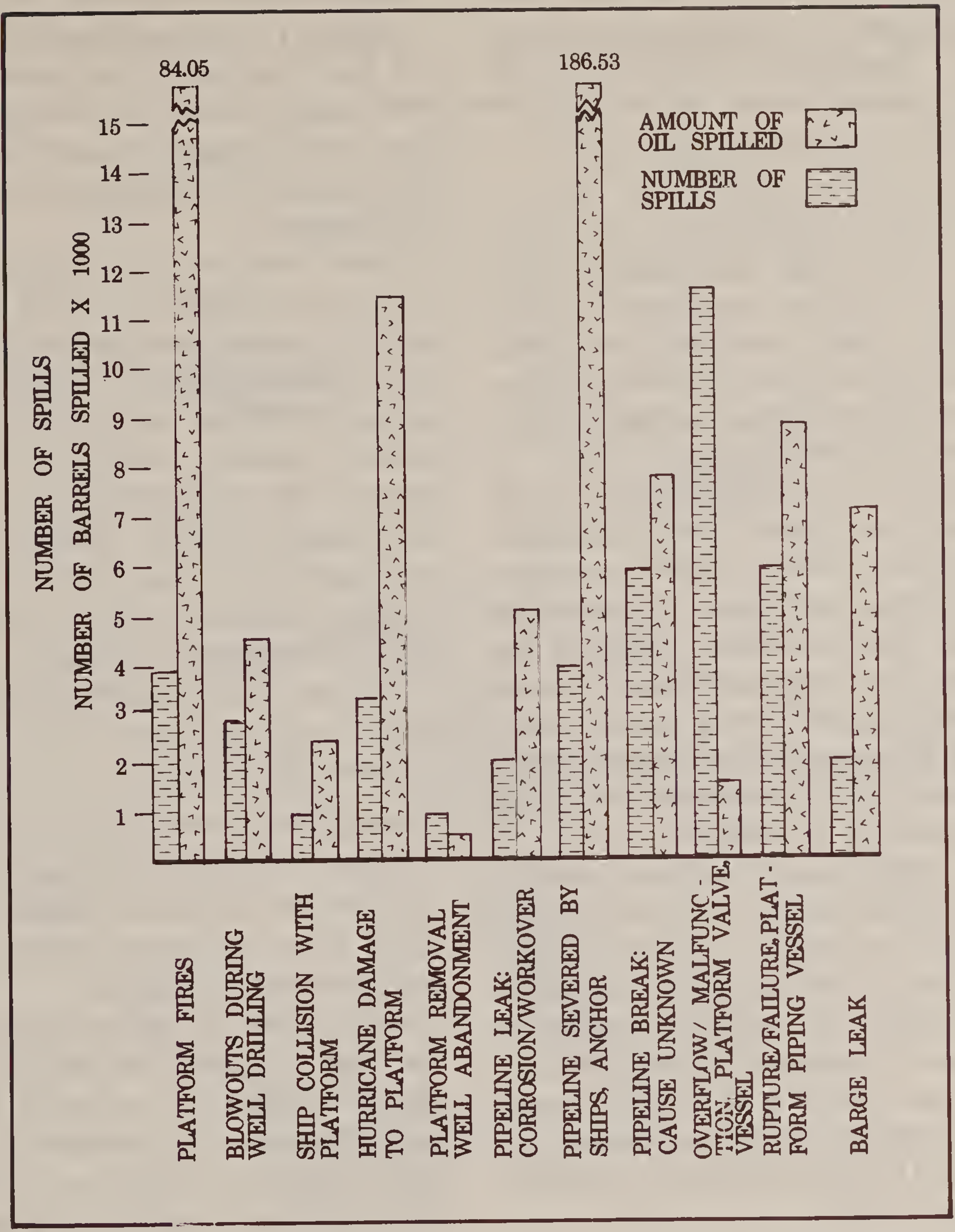

Figure A-1 Oil Spills ≥ 50 bbl. Number and Amount each blowout, but most blowouts causing spillage results from producing oil wells and not wells being drilled. Producing oil well blowouts are normally a result of equipment malfunctions, workover procedures, human errors, storms, and collisions with marine transportation.

### OIL SPILLS RESULTING FROM PLATFORM FIRES

Combustible hydrocarbon liquids or vapors making contact with arcing electrical or overheated mechanical devices undoubtedly cause most platform fires. More rarely they are ignited by lightning or static electricity. Sometimes platform fires involve the accidental ignition of fuel, solvent or heat exchanger fluids.

If producing wells are damaged to the extent that oil flows freely and ignites, they are usually allowed to burn while remote control operations are underway. In this way, most hydrocarbon liquid expelled by the well burns, reducing the fire hazard during relief operations and lowering ocean pollution levels. If a blowing well is releasing mostly natural gas, ocean pollution is minimal. However, personnel and the platform or drilling structure are imperiled in the event of a fire.

From 1964 to 1974, many platform fires of varying sizes occurred during OCS production. Most were extinguished without causing serious damage or pollution. Of 84 recorded explosions and fires, four resulted in spills amounting to 84,050 barrels; when compared to the total 10-year production, this results in a spillage rate of 0.0029%. Applying this rate to the anticipated annual production of 11 million barrels, 319 barrels would be spilled per year.

### TANKERS ACCIDENTS AND OPERATIONS

Accidents, carelessness or mismanagement releases almost 36.5 million barrels of oil annually into the world's oceans (Charter et al., 1973). Figure A-2 shows the percentage of total outflow from various polluting sources (Porricelli and Keith in press). Table A-3 shows the budget of petroleum hydrocarbons introduced into the oceans as compiled by the National Academy of Sciences (NAS, 1975). Figure A-3 further breaks down data on 269 polluting incidents involving tankers in 1969 and 1970, giving pollution volumes from tank barges and tankers, and from various types of tanker accidents.

About 98% of all the oil spilled by vessels is from incidents involving over 1,000 barrels. Most large tanker spills occur nearshore (within 80 km of land) when the vessel runs aground, rams a fixed structure or collides with another vessel.

During 1973, approximately 1,404 billion tons of oil were transported by tankers; about 1,355 billion tons of crude were similarly transported during 1971 (National Academy of Sciences, 1975). Ten billion barrels will be used in the spillage rate calculations.

From 1969 to 1973, a total of 950,000 long tons of oil were spilled by tankers (Card et al., 1975); average annual spill volume was 190,000 long tons (1.35 million barrels). A ratio of volume transported (10 billion barrels) to volume spilled 1.35 million barrels) results in a spillage rate of 0.013%. The CEQ (1974) report lists a spillage rate for tankers of 0.016%. Tankers will not be used to transport production from offshore to onshore facilities. Pipelines will carry the production from offshore platforms to onshore storage facilities.

The probability of an oil spill and number of spills increases as the amount of production increases (CEQ, 1974).

### MINOR SPILLS AND NATURAL SEEPS

Table A-4 lists annual totals of minor spills by number and volume. It should be noted that not all oil slicks are related to offshore drilling, transportation or production.

Most of the oil seeps that have been noted in the Gulf of Mexico are active. Studies were conducted by the U.S. Geological Survey around the Gulf of Mexico to determine (1) whether previously reported seeps are still active; (2) the characteristics of the seeping hydrocarbons; and (3) the amount of bitumen (asphalt found in a natural state) contained in the drainage leaving the seeps and entering the Gulf of Mexico.

When total minor spills in barrels per month are plotted against time, a smooth curve representing a constant 2.57% decline is noted. During the period 1970-1973, total oil and condensate production varied by less than 13%, whereas minor oil spill volume decreased almost 60%.

From 1970 to 1974, the spillage rate was 0.000274%. Projecting this rate to the present proposal's estimated maximum production of 11 million barrels per year, maximum minor spill level is 30 barrels per year. If the downward trend of minor spill volumes continues, the figure could be somewhat smaller. By definition, the maximum size of a single minor spill is less than 50 barrels.

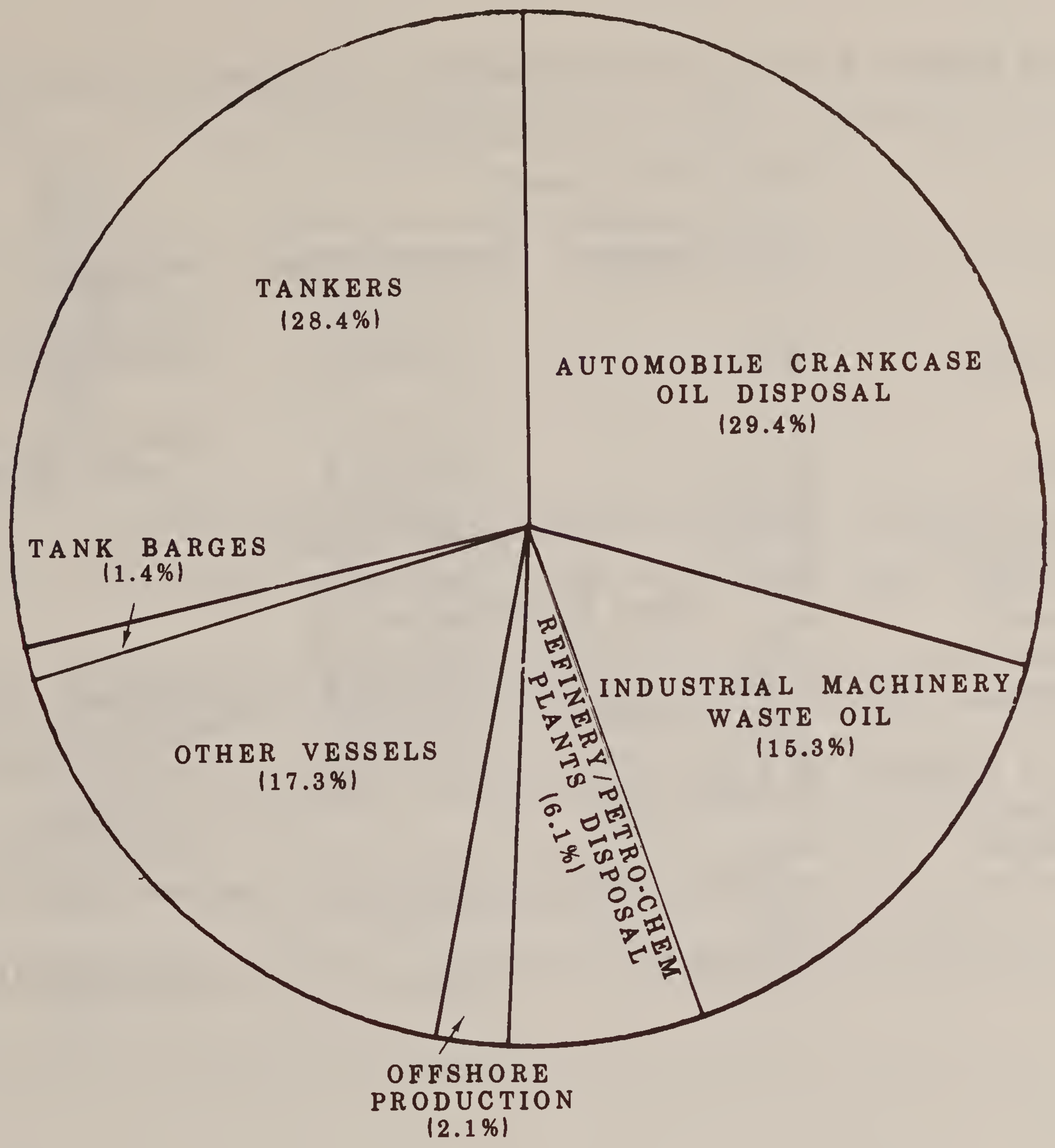

Figure A-2 Sources of Oil Pollution to the Oceans.

Source: Poricelli and Keith

Table A-3 Budget of Petroleum Hydrocarbons Introduced into the Oceans

| | Input Rate (mta)[a] | | |
|---|---|---|---|
| Source | Best Estimate | Probable Range | Reference |
| Natural seeps | 0.6 | 0.2-1.0 | Wilson et al. (1973) |
| Offshore production | 0.08 | 0.08-0.15 | Wilson et al. (1973) |
| Transportation | | | |
| LOT tankers | 0.31 | 0.15-0.4 | Results of workshop panel deliberations |
| Non-LOT tankers | 0.77 | 0.65-1.0 | |
| Dry docking | 0.25 | 0.2-0.3 | |
| Terminal operations | 0.003 | 0.0015-0.005 | |
| Bilges bunkering | 0.5 | 0.4-0.7 | |
| Tanker accidents | 0.2 | 0.12-0.25 | |
| Nontanker accidents | 0.1 | 0.02-0.15 | |
| Coastal refineries | 0.2 | 0.2-0.3 | Brummage (1973a) |
| Atmosphere | 0.6 | 0.4-0.8 | Feuerstein (1973) |
| Coastal municipal wastes | 0.3 | - | Storrs (1973) |
| Coastal, Nonrefining, industrial wastes | 0.3 | - | Storrs (1973) |
| Urban runoff | 0.3 | 0.1-0.5 | Storrs(1973)Hallhagen(1973) |
| River runoff | 1.6 | - | |
| TOTAL | 6.113 | | Storrs(1973)Hallhagen(1973) |

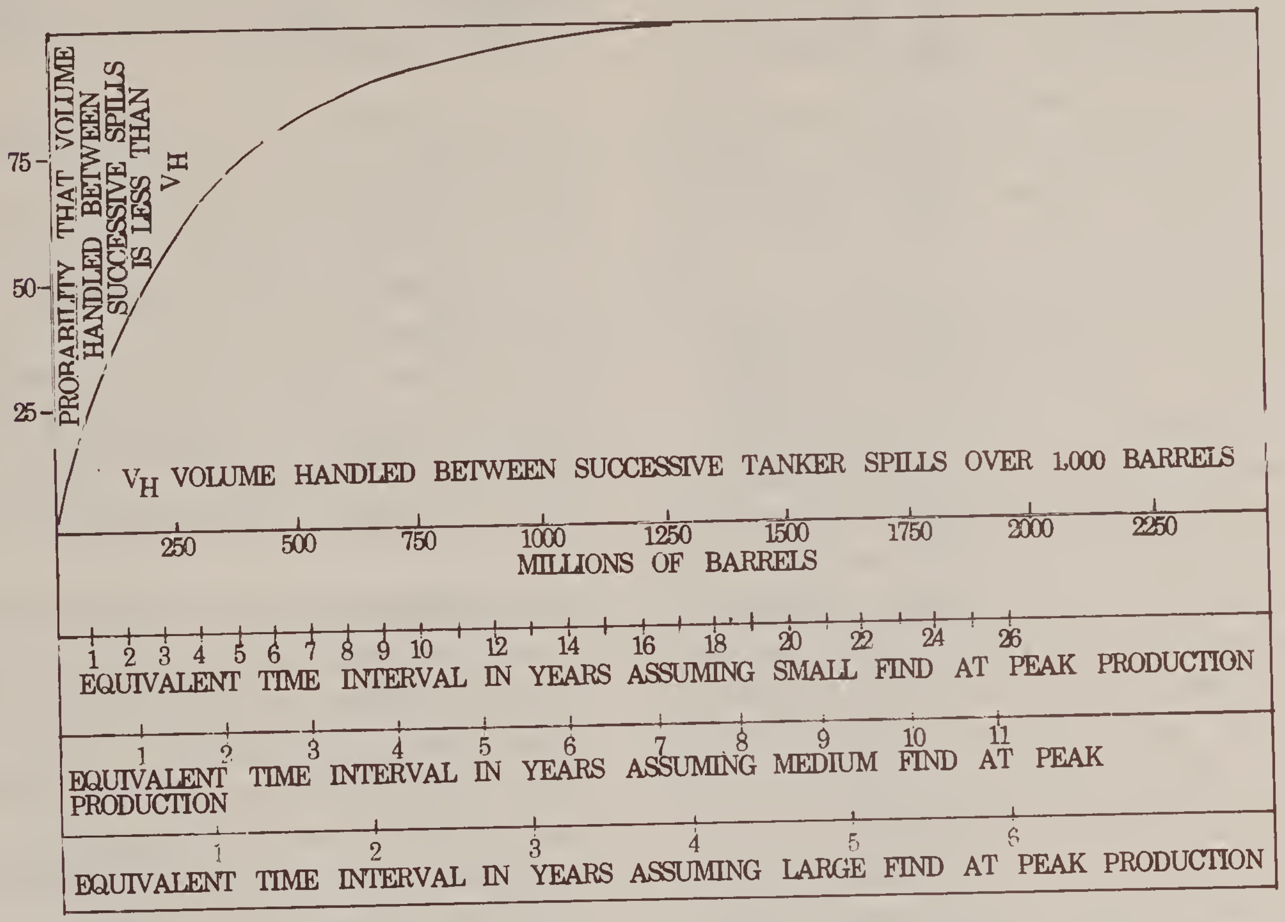

Figure A-3 Cumulative volume of oil handled between tanker spills larger than 1,000 barrels.

Source: MIT 1974

## Table A-4 OIL SPILL INCIDENTS - GULF OF MEXICO OCS

| Calendar Year | Incidents | Oil Spilled | Number of Fixed Structures | Annual OCS Production |
|---|---|---|---|---|
| 1964 | 5 | 14,928 barrels | 1,100 | 123 million barrels |
| 1965 | 2 | 2,188 barrels | 1,200 | 145 million barrels |
| 1966 | 0 | None | 1,325 | 189 million barrels |
| 1967 | 1 | 160,639 barrels | 1,450 | 222 million barrels |
| 1968 | 1 | 6,000 barrels | 1,575 | 269 million barrels |
| 1969 | 6 | 30,024 barrels | 1,675 | 313 million barrels |
| 1970 | 3 | 83,895 barrels | 1,800 | 361 million barrels |
| 1971 | 1 | 450 barrels | 1,891 | 419 million barrels |
| 1972 | 0 | None | 1,935 | 412 million barrels |
| 1973 | 4 | 22,175 barrels | 2,001 | 395 million barrels |
| 1974 | 2 | 22,046 barrels | 2,054 | 361 million barrels |
| 1975 | 1 | Unknown | 2,079 | *328 million barrels |
|  | 26 | 342,345 barrels |  | *3,537 million barrels |

*Estimate

Source: USGS, Conservation Division, Metairie, La. July, 1976.

### ACCIDENTAL SPILLS FROM OVERFLOW, MALFUNCTION, RUPTURE OR FAILURE OF PLATFORM PIPING VALVES

These are minor spills in which 50 barrels or more were lost before the condition was corrected. Accident records for the Gulf of Mexico indicate 12 such spills through 1973. Total spillage was 1,558 barrels, or an average of 130 barrels per spill.

Assuming these conditions, the rate of 1,558 barrels spilled to 2.9 billion barrels produced is 0.000054%. At a maximum production of 11 million barrels per year, the spillage in the proposed lease area would be six barrels per year.

In summary, an estimated 3,342 barrels of oil will be spilled annually (Table A-5) in the northern Gulf of Mexico. This does not include the 2,100 barrels spilled from the projected blowout of one well sometime during the life of production.

### Probability of Spills Due to Natural Phenomena

The preceding section dealt with estimates on the volume of oil that may be spilled annually as a result of human error and equipment failure. This section is devoted to oil spill probability estimates due to natural phenomena in the proposed sale area. The discussion, with minor changes, is taken from the CEQ (1974) report which estimated the likelihood of natural phenomena damaging or destroying an offshore structure. CEQ (1974) used an analytical approach considering design criteria, safety specifications of the structure and likelihood of a particular event.

Major offshore structures are designed to withstand an environmental stress as specified by the future owner or operator. Typically, forces associated with the 100-year storm have been the specified stress. However, there is always a chance that these forces will be exceeded, resulting in an oil spill. For example: Over a 30-year field life, the probability of at least one storm with forces greater than the 100-year storm is 26%; with forces greater than the 200-year storm, there is a 14% probability.

Based on several assumptions, including: the probability that a natural event will occur is adequately described by recurrence relations given in previous sections of their report; structural designers can develop designs that will withstand the forces of specific natural events (e.g., earthquakes with magnitudes less than 7.2), and a specific natural event will occur in the vicinity of an oil field, exposing the structures to the full forces associated with the event; the CEQ (1974) calculated the number of times oil spills can occur due to natural phenomena.

The field life (production period) of an oil reservoir depends on reservoir volume, depth of water at the site, amortization costs, and time required to develop the field. Based on past industry practice, field life for the northern Gulf of Mexico reservoirs will probably be between 20 and 40 years. Calculations were therefore made for 20-year, 30-year, and 40-year field life.

### ESTIMATE OF THE LIKELIHOOD OF PLATFORM COLLAPSE AND WELL BLOWOUT FROM STORMS

Unprotected wells can blow out if the platform collapses from excessive storm forces.

The probability of a storm exceeding the design has been calculated for design specifications of both 100- and 200-year storms with safety factors of 1.5 and 2.0. The analysis further assumed the platform would experience the full effects of a storm exceeding the design spectrum. If a platform collapses, conductor pipes will shear. However, the positive open control lines to the subsurface valve will also shear thus closing the valve and preventing loss of oil. Valves are not 100% reliable; however, recent tests show a 0.96 to 0.97 reliability. CEQ (1974) used 0.96 for their calculations. Industry is sponsoring research to identify the failure modes of subsurface valves to improve design and thus increase reliability. To show how improved reliability would reduce failure rates, the CEQ (1974) also selected a valve reliability of 0.99 for their calculations.

The value of improving reliability is illustrated in the following example: A platform in the proposed sale area is designed to withstand the 100-year storm and has a margin of safety of 1.5. If field life is 30 years, then the possibility of exceeding the platform design specifications during the life of the field is 0.14 (or 1 chance in 7). If subsurface valving is installed, the chance for a blowout is 0.006 (1 chance in 167) for a reliability of 0.96, and 0.0014 (1 chance in 700) for a reliability of 0.99.

Table A-6 illustrates two important points. First, likelihood of platform collapse increases linearly as the age of the field increases and decreases linearly as the design storm criteria is increased. For example, a platform designed for

## TABLE A-5

## Anticipated Annual Oil Spillage During Peak Production Results from the Proposed Sale

| Location | Source | Maximum Annual Spillage (bbls) |
|---|---|---|
| Gulf of Mexico | Pipeline accidents | 187 |
| | Formation water* | 2800 |
| | Spills from platform fires | 319 |
| | Overflow, malfunction, or rupture | 6 |
| | Minor spills (less than 50 bbls--all sources) | 30 |
| TOTAL | | 3,342 |

*Assuming all formation water is discharged.

## TABLE A-6

## Estimate of Platform Collapse and Well Blowout
## (Safety Valve Reliability - 0.96 and 0.99)

Field life in years

| Severe storm design standard | 20 | 30 | 40 | Remarks |
|---|---|---|---|---|
| 100-yr storm | | | | Average number of times severe storms will cause well blowout |
| Margin of safety - 1.5 | .09/.0036/.0009* | .14/.0056/.0014 | .19/.0076/.0019 | |
| Margin of safety - 2.0 | .04/.0016/.0004 | .07/.0028/.0007 | .08/.0032/.0008 | |
| 200-yr storm | | | | |
| Margin of safety - 1.5 | .05/.002/.0005 | .07/.0028/.0007 | .09/.0036/.0009 | |
| Margin of safety - 2.0 | .02/.0008/.0002 | .03/.0012/.0003 | .04/.0016/.0004 | |
| Combined Severe Storm and Tsunami | | | | |
| 100-yr storm | .001/.00004/.00001 | .0015/.00006/.000015 | .002/.00008/.00002 | |
| 200-yr storm | .0005/.00002/.000005 | .0007/.000028/.000007 | .001/.00004/.00001 | |

*Platform Collapse/Well Blowout = 0.96/Well Blowout R = 0.99
Reliability = 0.96/well blowout
R = 0.99

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Source: CEQ 1974

the 100-year storm in a 20-year field will have the same likelihood of failure (0.09) as a platform designed for the 200-year storm in a 40-year field.

### ESTIMATES OF THE LIKELIHOOD OF OIL SPILLAGE FROM STORAGE SYSTEMS

The three types of storage facilities are onshore, floating, and underwater facilities. Government regulations now require that dikes enclose onshore storage tanks so that if the tank fails, the released oil will not escape from the area. CEQ (1974) maintains, therefore, that the chance of oil spills due to natural phenomena is zero, provided dikes are not damaged. Damage to dikes is very dependent on quality of the soil foundation. It is extremely important that a thorough geologic investigation of the proposed site be made to confirm that the soil properties are satisfactory.

Although the use of floating and/or underwater storage systems are highly unlikely for this sale, their failure has been calculated. (Table A-7). Storms are the only natural phenomena affecting floating storage placed in deep water. The same linear relation exists between field life and more stringent design criteria. That is, if field life is doubled, then the recurrence interval for the design storm should be doubled, to maintain the same probability.

These estimates are based on the likelihood that a floating storage tank will break its moor and go adrift. If capsizing or grounding can be avoided, and if service craft can regain control of the drifting tanks, oil spillage will be averted. A spar-type floating storage will minimize capsizing. This system uses long vertical cylinders which are very stable and experience very little motion even in heavy seas. However, since it will usually extend several hundred feet below the surface, it must be moored in deep water.

Combining probabilities for all natural phenomena affecting floating and underwater storage in the Gulf of Mexico, underwater storage is more susceptible to damage by natural phenomena than floating storage.

To summarize, onshore storage is the safest form of storage in the Gulf of Mexico from the aspect of natural phenomena. When it is not feasible, floating storage is safer than underwater storage.

### ESTIMATES OF THE LIKELIHOOD OF NATURAL PHENOMENA DAMAGE TO TRANSPORTATION SYSTEMS

Properly designed, constructed and emplaced pipelines are relatively insensitive to all natural phenomena except ground faulting and slumping along the pipeline route. The possibility of soil stability loss cannot be assessed until after a thorough geologic analysis of the selected route and after selection of a valve location program. These steps are taken during the late stages of the exploration program and follow the decision that the reservoir warrants development.

### SUMMARY AND CONCLUSIONS

Table A-8 summarizes the effects of each of the natural elements, the volume of oil at risk, and the caveats regarding certain evaluations. Severe storms do not present a serious oil spill threat to any of the elements of the system. Threat to floating and underwater storage is ‘‘moderate’’ due to the volume of oil at risk.

The stability of soil beds including faulting also threatens pipelines. Careful route planning and an adequate valve program may relieve some risk.

Several typical oil production systems have been assembled and estimates of the value from the aspect of minimizing oil spillage are made for four typical oil production systems (Table A-9). Pipeline and onshore storage is considered best for this proposed sale area. Floating moors rather than fixed berths for tankers represent a lesser risk of massive oil spillage (CEQ, 1974).

## Oil Spill Trajectories in the Gulf of Mexico

Oil spills on the ocean surface are usually described in terms of spreading, drifting, and weathering. However, a combination of many factors controls oil movement and composition. A partial list of these factors includes: original composition, age, solubility, total amount introduced, concentration, dilution, evaporation, photo oxidation, absorption on suspended particulates, microbial degradation, spill treatment, water salinity, temperature, waves, winds, currents, season, geographical location, and climate.

## Results of Oil Spills in the Gulf of Mexico

### FATES AND EFFECTS OF OIL IN THE MARINE ENVIRONMENT

The following discussion was taken, with few changes, from the report of the workshop on ‘‘Inputs, Fates, and the Effects of Petroleum in

### TABLE A-7

### Average Number of Times that a Storage System will be Damaged as a Result of Natural Phenomena

| | Field Life in Years | | | |
|---|---|---|---|---|
| | 20 | 30 | 40 | Remarks |
| Ashore | 0.0 | 0.9 | 0.0 | Dikes have 100% reliability against damaging oil spill |
| Afloat | | | | |
| 100-yr storm | | | | |
| Margin of safety - 1.5 | .095 | .14 | .19 | Average number of times severe storms will cause parting of floating storage moor |
| Margin of safety - 2.0 | .044 | .066 | .088 | |
| 200-yr storm | | | | |
| Margin of safety - 1.5 | .047 | .070 | .093 | |
| Margin of safety - 2.0 | .022 | .033 | .044 | |
| Underwater | | | | |
| 100-yr storm | | | | |
| Margin of safety - 1.5 | .095 | .14 | .19 | Average number of times severe storms will damage or destroy underwater tanks |
| Margin of safety - 2.0 | .044 | .066 | .088 | |

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Source: CEQ 1974

## TABLE A-8 SUMMARY OF THE EFFECT OF NATURAL PHENOMENA ON VARIOUS ELEMENTS OF THE OIL PRODUCTION SYSTEM.

Natural Phenomena

| ELEMENT | | SEVERE STORM | VOLUME OF OIL AT RISK PER EVENT |
|---|---|---|---|
| PLATFORM | | SLIGHT (note 1) | 500 to 1500 BBLS/Well/Day |
| PIPELINE | | NONE | 10,000 BBLS or More |
| STORAGE | ASHORE | SLIGHT (note 5) | Up to 1,000,000 BBLS or Greater (note 7) |
| | AFLOAT | MODERATE | 200,000 TO 1,000,000 BBLS |
| | UNDERWATER | MODERATE | 100,000 BBLS or Greater |
| UNDERWAY | | SLIGHT (note 10) | 500,000 to 2,000,000 BBLS |
| MOORED-SPM | | SLIGHT (note 11) | |
| FIXED BERTH | | SLIGHT | |

NOTES:

1. Storm forces are comparable to those in the North Sea.
2. Provided earthquake resistant design features are used.
3. Provided careful soil analysis program is followed.
4. It may be possible to reduce threat by line routing over less susceptible areas.
5. Provided tanks are sited away from flood prone areas.
6. Provided free surface effect is reduced.
7. Dikes give protection against damaging oil spill.
8. Assumes control can be regained before floating storage grounds or capsizes.
9. Provided floating storage is moored in deep water.
10. Assumes regular inspections and prudent seamanship.
11. Assumes ship control is regained before grounding.

SOURCE: CEQ 1974

TABLE A-9 EVALUATION OF VARIOUS COMBINATIONS OF ELEMENTS BASED ON LOWEST PROBABILITY OF OIL SPILLS

| | SYSTEM A | SYSTEM B | SYSTEM C | SYSTEM D |
|---|---|---|---|---|
| | WELLHEAD<br>PIPELINE<br>STORAGE ASHORE<br>TANKER (FIXED BERTH) | WELLHEAD<br>PIPELINE<br>STORAGE ASHORE<br>TANKER (SPM) | WELLHEAD<br>UNDERWATER STORAGE<br>TANKER (SPM) | WELLHEAD<br>FLOATING STORAGE<br>TANKER (SPM) |
| GULF OF MEXICO | POOR | BEST | POOR | GOOD |

Source: CEQ 1974

the Marine Environment", *Petroleum in the Marine Environment*, National Academy of Sciences (1975).

This section represents an attempt to discuss in summary form the fate of an oil spill on the sea, from its initial fluid, unmodified condition through its final residual forms. The resulting slick is dispersed by physical forces and chemically modified by oxidative and biological processes. As the spill ages, the relative impact of the various dispersive and degradative processes shifts from the rapid physical effects to slower chemical and biological modifications. The rate of dispersion of a spill is primarily a function of air-sea dynamics, chemical and physical properties of the oil, and the magnitude of the spill. In spite of the seeming complexity of this problem, it is possible to identify stages in the lifetime of a spill and to assign priorities to the processes acting to modify it. An understanding of anticipated events is essential for designing and deploying oil recovery equipment, interpreting aerial spill surveillance data, and tracing a petroleum residue to its source in order to determine the fate of oil on the sea.

These processes can be divided into three stages. Initially, the fluid spill spreads rapidly under the influence of gravitational and surface chemical effects. The polar, surface active constituents (containing nitrogen, oxygen, and sulfur) are highly influential in spreading the spill into extremely thin layers that approach non-molecular dimensions at the outer edges of the slick. In addition, the extent and rate of slick growth is determined by wind, waves, and current and by the density and viscosity of the spilled petroleum. The rate of most dispersive processes is greatly enhanced by spreading the oil into thin layers. Thus, surface-to-volume ratio of the spill increases and a greater exposure to air, sea, and sunlight results. In this early stage, evaporation is the predominant dispersal process, and its rate increases with winds and the further spreading of the spill. In rough seas with breaking water and wave-induced surface contractions, oil is emulsified into the ocean. The entrained oil may also be sedimented by adsorption onto nonbuoyant particulate matter. Another process occurring in rough weather is the transport of oil into the atmosphere by ejection of oil-coated drops from sea spray and bursting bubbles. Fallout of this oily mist usually returns to the sea downwind and usually is outside of the initial spill. If the spill had occurred in coastal waters, it may fall out on nearby land.

It is difficult to determine whether the dissolution rate will increase or decrease with time. Dissolution is slow for most of the compounds found in petroleum: The more soluble compounds, spread into thin layers initially, will dissolve in the underlying water. Organic acids will be solubilized by reaction with the relatively alkaline seawater, and photocatalyzed oxidation may produce species more volatile or soluble than the parent compound. Processes of this kind achieve a more important dispersant role at a later stage in the life of the spill after the most volatile compounds have been evaporated. In this mesostage, photochemical and biological degradation assumes a more dominant role. The expansion of the slick by spreading has essentially ceased. The rate of dispersion of the thin external portions of the spill is balanced by the rate of spread from thicker central portions. In addition, for crude and residual fuels, loss of light ends creates a more viscous substance that does not flow readily along the air-water interface.

Thus, the density and viscosity of the residue increase, and eventually the third, most refractory stage is reached. The size of the resulting tarry residue is large when thick layers have weathered under relatively mild meteorological conditions. Smaller fragments are produced by waves and breaking water. Further degradation, weathering and interaction with the environment is extremely slow since the surface-to-volume ratio of unspread tar is small, and most dispersive reactions occur at interfaces. More importantly, since the petroleum residue is nonfluid, additional spreading ceases and the internal contents become encapsulated and isolated from effective interaction with dispersive and degradative processes. Microbial degradation becomes important as populations of hydrocarbon-adapted bacteria develop.

Although distillate fuels would undergo many of the dispersive processes listed above, there would be little tendency to form tar balls. However, because most of the petroleum spilled on the sea surface contains non-volatile, high-molecular-weight components, tar formation is likely. These sources include accidental spills, bilge pumping, and tank-cleaning operations, as well as input from land-based sources and undersea seeps.

It is important to note that although the initial dispersion of a slick is fairly well understood, the longer term process (except possibly for bacterial degradation of normal paraffins) has not been studied under field conditions. Much of what we have presented is thus an extrapolation of processes studied mainly in the laboratory and should be verified by field studies.

At present, field data are rather sparse, making it difficult to generalize sufficiently to predict the probable levels of petroleum residues in a given area where their effects might be important (e.g., an estuary). In addition, the distinction has not always been made between hydrocarbon materials resulting from natural sources such as biosynthesis or crude oil seeps. Time-series data for petroleum residues are available only for a few locations such as Florida (Dennis, 1959), Bermuda (Butler et al., 1973), and West Falmouth (Blumer et al., 1970b), (Blumer and Sass, 1972), and even in these locations, surveys cover only a few years. In the following, reservoirs of petroleum (principally hydrocarbon) residues are classed as atmosphere, sea surface microlayer, pelagic tar, water column, and sediments.

Few of the available measurements of atmospheric hydrocarbon concentration are good measures of the reservoir of petroleum hydrocarbons in the atmosphere over the sea. Furthermore, most of the atmospheric hydrocarbons are low-molecular-weight (methane to $C_6$) and would not enter other parts of the marine environment without first being oxidized or possibly adsorbed on particulate matter.

Although hydrocarbons themselves are not surface active, they tend to be accumulated at the sea surface by naturally occurring surfactants.

One important consideration is that oil slicks or surface films in nonslick areas may act as a differential accumulation center for trace materials (Filby and Shah, 1971, Guinn and Bellance, 1970) such as metal ions, vitamins, amino acids and such lipophilic pollutants as DDT residues and PCB (Duce et al., 1972, Guinn and Wade, 1972). Whatever ecological effects these materials have on the life near and at the sea surface, they may be substantially altered by the presence of oil slicks; and as a result, the ecology of the sea surface may be changed with possible consequent impacts on other pelagic life (Feldman, 1970).

In the last few years a number of quantitative measurements of the weight of tar lumps collected by neuston nets have been published.

There is a suggestively strong correlation between the observation of high levels of pelagic tar and known tanker routes of high traffic.

Distinguishing tar lumps formed from natural crude oil seeps and those resulting from tanker operations is clearly important, but criteria for such distinctions are still being developed. We have already mentioned the presence of $C_{30}$—$C_{40}$ paraffinic waxes as being indicative of crude oil sludge (hence tanker) origin, and the presence of relatively large amounts of iron as being strong evidence for person-caused sources.

If the input of petroleum to the world oceans from natural seeps is about 10% of the total, one might expect to find some tar lumps of natural origin in areas where there are substantial seeps. At present, the surveys of tar quantities are too scattered to permit any specific correlation, but multiparameter analysis of oil from various known seeps and from tar lumps collected in nearby regions might permit some significant correlations to be made. There is reason to believe, however, that since natural seeps contribute crude oil at a slow, more or less steady rate (Allen et al., 1970), the resulting oil slick would be expected to be quite thin and the tar lumps (if any) formed from it would be expected to be of different character from those formed by tanker residues. For example, Ludwig and Carter (1961) reported gas bubbles in tar formed from natural seeps. As mentioned above, aggregation of small lumps does not seem to be a significant mode of tar-lump formation, and thus the large pelagic tar lumps collected by most workers would seem to be most likely the result of tanker operations and possible bilge pumping.

Modification of tanker practice to emulsify wastes before dumping would tend to decrease the amount of pelagic tar but increase the amounts in the subsurface water column. Whether the degradation rate to $CO_2$ would be enhanced by such a change, or whether the sublethal effects on the ocean ecosystem would be increased, are both open to question at present.

In addition to tar lumps, petroleum residues also enter the dissolved and particulate hydrocarbon pool in the deeper oceans. Conflicting results and controversy about methods makes any quantitative estimate very uncertain at this time. The surface values in the open ocean appear to be less than 10 ug/liter, and subsurface values are much lower.

Biogenic hydrocarbon input may be comparable: approximately three million tons per year (Revelle et al., 1971) to 10 million tons per year (Button, 1971). At the low concentrations found, distinction between biogenic and petroleum hydrocarbons is still beyond the state of the art. However, indirect inference from correlations with phytoplankton may give some information (Zsolnay, 1973). Of course, a great deal of further field and analytical work would be required to verify this.

Total worldwide hydrocarbon concentration (including biogenic compounds) in surface sediment samples determined by a variety of techniques, cover the 0.1-12 ppt range (usually <1 ppt) in highly polluted coastal areas, less than 100 ppm (usually <70 ppm) in unpolluted coastal areas and deep marginal seas or basins, and 1-4 ppm (including about 90% biogenic) in deep sea areas.

The effects of oil spills may be acute or chronic in nature. Acute effects on the biota are those that result from a single infusion of oil into the marine environment from an accidental spill. Mortalities due to petroleum and its by-products may occur almost simultaneously with, or at any time after, the appearance of the oil in the environment. The effects may be due to chemical or physical characteristics of the petroleum. One such effect is the smothering or asphyxiation of organisms by a coating of oil.

Some spills occur within confined marine areas, such as bays or estuaries, where the concentration may remain high for extended periods causing the biological impacts to be greater than if the oil were released where rapid dispersion could take place. Such releases are generally large compared with chronic low-level additions, and furthermore, they commonly occur in coastal waters where man makes maximum use of marine resources.

The public is concerned when seabirds at nearby beaches and nesting areas are oiled and when shellfish are killed or tainted such that they are unpalatable. When beaches are polluted with oil, public use decreases.

Chronic effects are those that occur from the release of crude oil or its derivatives either continuously or sufficiently often that the biota does not have time to recover between doses. Other activities associated with the petroleum and other industries may have a long-term or chronic effect on aquatic organisms. For example, dredging and filling of marshes can modify organism habitats and either kill or have sublethal effects on individual organisms. The sublethal modifications may affect the characteristics of the populations of each species, changing the rates of birth, death, and dispersal, as well as the age structure and spatial pattern. Also, changes in the ecological communities may occur in the affected area.

There are various levels of biological effects of oil. At various places in the marine environment and at various times these will be accorded different priorities in the evaluation of the impact. These effects include the possibility of:

Human hazard through eating contaminated seafood;
Decrease of fisheries resources or damage to wildlife such as seabirds and marine mammals;
Decrease of aesthetic values due to unsightly slicks or oiled beaches;
Modification of marine ecosystem by elimination of species with an initial decrease in diversity and productivity;
Modification of habitats, delaying or preventing recolonization.

When an oil spill occurs, many factors determine whether that spill will cause heavy, long-lasting biological damage, comparatively little or no damage, or some intermediate degree of damage. An example of the variability that exists among the effects of oil spills on the marine biota is outlined by Mitchell et al. (1970) in his description of the widely different effects resulting from the Tampico Maru and the Santa Barbara oil spills. Several factors apparently contributing to the difference in those effects are compared. Straughan (1972) also identifies various factors that influence the extent of biological damage from an oil spill.

If the spill occurs in a small, confined area so that the oil is unable to escape, damage will be greater, almost without exception, for a given volume and type of oil spilled than if that same volume were released in a relatively open area. At the Tampico Maru site, 60,000 barrels of diesel fuel were spilled in a small cove, whereas at Santa Barbara 75,000 barrels of crude oil were spilled in an open ocean channel. The Tampico Maru spill had greater, more persistent damage than the Santa Barbara spill, most likely because it occurred in a confined area. Thus, where the spill occurs, as well as the volume of oil spilled, are both important factors.

The Tampico Maru spill involved No. 2 diesel fuel and the Santa Barbara spill involved crude oil (Mitchell et al., 1970); because No. 2 diesel fuel oil contains more aromatic compounds, it is more toxic. The type of oil spilled may be the most important factor, as evidenced by the difference in severity accompanying the spill by the barge Florida at West Falmouth, Massachusetts (Blumer et al., 1971a), which was carrying No. 2 diesel fuel oil, and the Torrey Canyon spill, which involved Kuwait crude oil (Smith, 1968). A definitive study of the difference in toxicity among various oils is reported by Ottway (1970), who showed that the susceptibility of a snail, *Littorina littorea*, varied markedly according to which of 20 test oils it was exposed.

Currents, wave action, and coastal formation all combine to influence the dosage of a given spill. Currents and wave action, especially in an open body of water such as a large bay, channel, or the open ocean, dilute the spilled oil, thereby reducing the toxicity of the spilled oil (Straughan, 1972).

Normally, storms will increase wave action and thereby reduce the toxic properties of the spilled oil by dilution. On occasion, however, wave action may intensify the problems, as apparently occurred at the West Falmouth spill. Soon after this spill, the surf drove the oil ashore into the sediments and the surrounding marshland. The oiled marshland and sediments then became a reservoir of oil for many months (Blumer et al., 1971a).

The amount of turbidity in the water is significant in determining the fate of the spilled oil. If the water contains suspended sediments or solids, much of the oil will sink. At Santa Barbara (Kolpack, 1971) the spill occurred during a period of heavy storms that caused considerable freshwater runoff. Sediments that were introduced by the flood waters into the nearby coastal waters provided an adsorptive surface for the spilled oil. Upon wetting the sediment surfaces, the oil flocculated the particles and subsequently sank. Such sedimentation is advantageous if the intertidal life is abundant, but it may be detrimental to benthic life (Blumer et al., 1971a).

The season of the year in relation to the life cycle of a given organism can frequently be the factor determining whether the effect of a spill is severe or relatively light (Straughan, 1972). For example, if a spill occurs during the winter in an area where seabirds are nesting, bird mortality may be in the thousands; at some other time of the year, the mortality would be much lower. Similarly, if a spill occurs in an estuary when fish fry are going into the Gulf, a much higher kill is likely. Crab larva, which float near the surface of the water in their zoea form, will probably be killed if a spill occurs during this stage of their life cycle (Mironov, 1969). Newly set oyster spats are also exceedingly vulnerable. However, such damage would not occur at other times of the year when these organisms are at a different stage of development.

Straughan (1972) reports that at Santa Barbara the barnacle *Balanus glandula* was not as easily smothered by oil as the barnacle *Chthamalus fissus*. *Balanus glandula* is larger in size and can survive a thicker layer of oil encrusted on the shoreline. Also, it has a calcareous base plate, whereas the smaller barnacles do not; because the plate prevented direct exposure to the substrate, it resettled earlier. According to Straughan's observations, the type of biota is important in assessing damage.

At present, mechanical methods are the least damaging methods of cleaning up oil spills (Straughan, 1972, Gatteleir et al., 1973). Such methods involve the use of booms and skimmers or absorbents.

Sinking agents, such as sand and stearated chalk, are another method of cleanup. The precise fate of sunken oil would indicate that further experiments are needed before this method can be recommended. Sinking may extend the period that the benthic fauna may be affected (Struzewski and Dewling, 1969).

The use of dispersants is another controversial method. According to Cowell (1971) and Smith (1968), most of the damage that occurred at the Torrey Canyon spill was caused, not by the use of dispersants, but by their misuse. Specifically the dispersants were applied undiluted to oil after it had come ashore. Moreover, Beynon (1970) and Canevari (1971) point out that since the Torrey Canyon incident, dispersants have been developed that are far less toxic and, if properly used, pose a minimum threat to or burden on the marine environment.

Those opposed to the use of dispersants claim that dispersing the oil into the water column renders the oil easier for marine organisms to assimilate (Blumer, 1969a, b; Murphy and McCarthy, 1970). Dewling (1971) pointed out that the use of dispersants, especially in rivers and estuaries, imposes an added burden on the assimilative capacity of the river or estuarine system to biodegrade the oil/dispersant mixture.

Straughan (1972) points out that in certain circumstances such as the protection of an endangered species of birds, the use of low-toxicity dispersants may override all other considerations. Beynon (1971) stresses the advantage of using dispersants on oil spills to prevent the oil from washing ashore and killing intertidal organisms because of its toxicity or by smothering.

Because opinion is polarized concerning the use of dispersant, research under field conditions is needed to establish the conditions and circumstances under which dispersants can be used effectively.

In addition to variables in effects caused by physical factors another set of variable effects is caused by the type of substrates with which the oil comes in contact.

Oil trapped in tide pools on falling tides can saturate small volumes of water with dissolved organics for periods ranging to several hours. Toxicities might become intensified as a result. Oil deposits on attached epifauna and flora can result in layers several centimeters thick. Usually such material is at least partially removed by the rising tide. Toxic effects may appear where stranded oil contacts tissues directly, such as on plant life (Holmes, 1969). Smothering may develop when tarry residues build up (Straughan, 1971).

Oil stranded on beached or falling tides tend to percolate into the sediments, which provides an opportunity for intimate contact with the infauna. Sedimentary transport processes can move the oily particles away from the region of initial contact, thus extending them along the shore as well as to subtidal waters.

Any oil absorbed by sediment grains may be exposed when the wave scour removes the overburden. Logically, oil dispersed as fine films on small particles should be ideally suited for microbial attack, but rapid degradation requires abundant oxygen, and sediments may easily become anerobic, thus delaying degradation by microorganisms. Oil trapped in sandy English beaches persisted for several months. (Smith, 1968) and was not released until later by various agents.

Oil stranded in marshland also enters sediments and can penetrate at least 70 cm (Burns and Teal, 1971). Oil residues were detected in organisms from various levels of the food web approximately a year after the West Falmouth spill in the Wild Harbor River Marsh (Burns and Teal, 1971). Also, substantial quantities of residues were recovered about 1½ years after the West Falmouth spill.

Studies of the estuarine and marshy waters affected by the West Falmouth spill indicate that oil spilled in this type of habitat could have far-reaching effects if spawning and nursery functions became affected. Blumer et al., (1970a) recorded an unexpected rise in sedimentary oil content of the estuarine muds in Wild Harbor many months after the initial spill. This rise was attributed to a release of oily material from the nearby marshland. The new infusion caused additional adverse effects among the infauna (Sanders et al., 1972). The system was thus able to ''store'' oil for later release.

Usually, oil floats on the sea surface, but several mechanisms can sink it, thus exposing subtidal communities. For oil to sink, sedimentary particles must contact the slick, forming a denser aggregate of oil-coated particulates that can settle. Such processes may occur in surf (North et al., 1964) from stranding in the intertidal area (Blumer et al., 1970a), or from contact with turbid runoff (Kolpack, 1971).

Oil may be introduced with brines that are associated with its production. Separation of petroleum from aqueous phases is never complete. When the brines are discharged into coastal water, they may carry with them from 10 to 50 ppm oil and even higher quantities of other noxious substances. The soluble fractions of petroleum probably are the most harmful to marine organisms. The characteristics of estuaries may combine with the chronic introduction of oil wastes from brines to intensify biological effects.

In addition, the slow dispersal of oil in some estuaries can increase adsorption onto suspended particulate matter. When these suspended particulates are incorporated in the sediments, the exposure of benthic organisms to oil is increased. The high biological productivity of estuaries ensures the exposure of many organisms to the wastes, particularly in the sensitive stages of their life history. Synergistic interactions between extremes of temperature and salinity and oil may aggravate deleterious effects. Therefore, because they combine biological productivity with the most severe exposure to wastes, estuaries are most vulnerable to the serious effects of chronic oil pollution.

Biological effects from large oil spills vary so widely that it is difficult to generalize on any specific topic such as productivity. Damage to plants can occur during acute phases of spills. Such effects have been recorded for phytoplankton (Mironov, 1970), attached algae (North et al., 1964), and flowering plants (Holmes, 1969). Hellebust, (1975) reported that algae growing on periphyton traps were strongly inhibited by the presence of oil. Among those species showing retarded growth was the desmid Cosmarium, while the blue-green *O. augustissima* was stimulated. Sedge, horsetail and moss surface contact with oil proved damaging in terms of chlorophyll loss, while below surface roots fared well. Submerged mosses were unaffected while emergent sections of the same species were killed outright. Documentation that shows plant life surviving virtually unharmed after oil spills is also available (Smith, 1968, Straughan, 1972). Plants are relatively resistant to toxicity from oil and require substantial exposure under natural conditions before significant damage results.

Productivity may be limited by the availability of nutrients or by activities of herbivores. Nutrient availability is probably not affected by oil, but destruction of herbivores can occur. Many macroinvertebrate grazers require months or years to develop. If grazing populations are seriously reduced by catastrophe, algal blooms of rapidly growing species can appear.

Presumably similar effects may occur in a planktonic situation. The time scale involved in phytoplankton blooms due to similar causes is much shorter than for kelp beds and other attached algae.

Oil at very low concentrations, which causes no direct mortality, may have some adverse effects on populations and, in turn, on natural communities.

Because organisms have different tolerances to oil and oil products, changes in relative abundances can occur. Within a trophic level, resistant species may flourish when populations of sensitive species decline and make available previously limited resources. Between trophic levels, a reduction in the number of grazers can lead to drastic habitat changes with the establishment of a canopy of macroalgae (North et al., 1969) and the shading out of the diatom flora on the substrate. Subtle disturbances to populations and communities could arise from or because of interference with chemical communications involved in feeding and mating.

Any possible effect on fishery productivity is of prime concern in coastal areas where there are chronic inputs of petroleum hydrocarbons. Although most evidence indicates that chronic pollution by petroleum has not seriously affected fishery productivity along large sections of the coasts of Louisiana and the North Sea, the threat of chronic pollution on the fisheries resources of restricted sections of these coasts cannot be dismissed. Although adult fishes may hardly suffer, nursery areas may be seriously affected as a result of smothering or poisoning of the multitudes of small organisms living in and on the top layer of the sediments on which juvenile fishes and shrimp feed.

Generally, fish do not suffer directly from sinking of oil but may acquire an aberrant flavor by feeding on benthic organisms carrying oil droplets. Even if the area were an important feeding ground for fishes of commercial importance, an appreciable mortality would not occur among such fishes, but they might become tainted, which would affect the fish industry economically.

Where spills occur in spawning grounds, sinking of oil may have serious adverse effects during or shortly after spawning periods for a species like the herring, which deposits its eggs on various bottom objects. Nursery grounds that are located in shallow sheltered areas could be especially vulnerable when large quantities of oil destroy the food organisms for the juvenile fishes and shrimp. To date, however, this has not been recorded.

Communities differ greatly in the time required for reestablishment following catastrophes. Planktonic communities display seasonal changes and their generation times are measured in weeks or months, while some benthic communities require years to attain maturity. Presumably persistence of catastrophic effects would be much more enduring in a long-lived benthic community than in a planktonic assemblage.

The recovery of polluted areas varies greatly, depending on the flushing of the polluted area, the type of the sediments on the substrata, and the degree of isolation of its ecosystems and the kinds of organisms that form them. The time periods for recovery may vary from a few months to several years. In general, the initial stages of recovery are characterized by opportunistic species that are often very productive, with a much longer time required to restore the community to one that supports more long-lived species.

One characteristic of organisms composing an ecological community that may affect its stability and rate of recovery is, for example, a slow rate of reproduction or growth. Such a characteristic increases the vulnerability of a species or ecological community to damage from oil or any other pollution.

There are certain common species of planktonic larvae that live only in brackish regions of estuaries. If these drifted passively in the current, they would be washed out into the open Gulf and lost; instead, they dive deeper after drifting toward the mouth of the estuary and are carried by the deeper currents back up to where they were spawned in the brackish regions. Thus, if the estuary is an isolated one, almost all the recruitment of these organisms is from the offspring of the resident population. If this population were completely destroyed by pollution, recolonization by chance immigration from another estuary would probably take a long time. The resident population of estuaries provides shelter and food for the young stages of many commercially important marine organisms (shrimp, fish, etc.).

Partly because of their isolation, the ecological communities of coastal marshes and estuaries are particularly vulnerable to the activities associated with petroleum exploration and production. The dredging to install rigs and pipelines may severely alter an estuary, and changes in the hydrology that bring about a greater incursion of higher salinity water may have severe effects on the aquatic life attuned to a given amount of salinity.

Nuzzi (1973) experimented with soluble extracts' effects on axenic cultures and natural populations of phytoplankton. He noted that in natural populations of the New York port area water soluble materials from #6 have little effect, while those from outboard motor oil seem to stimulate growth of several species. Soluble extracts of #2 oil generally appear to inhibit growth.

Prousel (et al. 1976) experimented with three oil-seawater mixes upon growth of unialgal cultures of marine phytoplankton while no strong inhibition was found, minor short-term inhibitions were evident at higher concentrations. (Inhibitions were short-term because of the relatively short half-life of oil in the water column.) We note that any inhibition to plant cells from oil indicates that concern for hydrocarbons' effects on phytoplankton is still warranted.

### Oil Spill Case Scenarios

The impacts considered throughout this section have been projected using our assumed oil spill figure of about 13,000 to 45,000 barrels. However, the following three hypothetical case scenarios involving large and small oil spills are presented to give perspective on the possible fate of an oil spill in the Gulf of Mexico. A large spill was modeled after the Santa Barbara blowout, but there are three cases regarding the fate of the oil, each case potentially affecting different resources. A smaller spill originating from a drilling mishap, pipeline rupture or barging accident has also been presented.

The large spill scenario is a rough estimation of the near maximum impacts resulting from a large spill. The many variables affecting the fate and impact of an oil spill make it extremely difficult, if not impossible, to predict the exact outcome of a large spill.

*Large Spill Definition:*

The spill will involve a total of 4.2 million gallons (100,000 barrels) of oil spilled over a 61-day period. The rate is 210,000 gal. (5,000 bbl.) per day for the first 11 days (2.31 million gallons or 55,000 bbl.) followed by a decrease to 37,800 gal. (900 bbl.) per day for the remaining 50 days. The figure of 100,000 barrels, rate and duration is similar to that reported by Allen and cited in Battelle Northwest (1970) during the Santa Barbara blowout. The largest spill reported in the Gulf of Mexico is 160,000 barrels (USGS, 1971), so although the impact of our hypothetical spill would be negative, it is not the maximum amount possible. However, it should be noted that this spill occurred prior to pressure-sensor and continuous-volume recording requirements and the reoccurrence of this type of incident is highly unlikely.

Conversely, the official U.S. Geological Survey estimate of oil spilled during the Santa Barbara blowout was 10,000 bbl. If this were true, the Santa Barbara blowout, in comparison with other OCS spills, would be far from a maximum OCS spill, and not a realistic spill from which to model a high case scenario. Because of the wide area covered and length of time that oil flowed during the Santa Barbara spill, it is more realistic to accept Allen's higher spill figures and consider them as a severe near maximum spill.

*Small Spill Definition:*

This is a spill of 500 barrels resulting either from a tanker accident, pipeline rupture, or platform accident. Rather than describing specific cases involving oil movement of various kinds, we will leave this a generalized spill which can be applied to any circumstance.

Although the high winds required to rapidly transport the oil slick to shore reduced its volatile toxic fractions faster than under calm seas, the detoxification would be less than if the slick drifted on the ocean for several days before it reached shore.

Although the large spill scenario uses a discharge rate to obtain oil masses at various times after the initial spill, through the lack of a better method, the oil mass spreading was determined by equations that deal with spill volumes rather than rates of discharge. These equations used to calculate the spreading of oil over calm water do not consider physical movement (wind, waves, current, and tides) in the calculations.

Tables A-10 and A-11 derived from Fay's (1971) and Blokker's (1964) equations respectively, give the areas over which the oil mass volume may spread.

Since Fay's and Blokker's equations do not consider ambient movement or discharge rate, it is probable that the slick lengths, which were previously considered maximum, are conceivable minimum slick sizes due to the nonconsideration of local physical forces within the equation.

The Blokker constant and oil and water specific gravities arbitrarily used are 1,000 and 0.85 and 1.00 respectively. The data from the two tables, derived from Fay's and Blokker's equations, agree fairly well for each specific spill volume except for the fourth case in each table. Therefore, it is inferred that the maximum distance an oil volume will spread, on calm water, for each of the oil spill volumes given in Tables A-10 and A-11 is correct.

Murray et al., (1970) indicates, ''For a given oil spill incident the current speed largely determines the size a slick will reach''. It is further indicated that high discharges may elongate slicks and that high current speeds (Chevron incident observed) minimize the slick size and enhance the rate of oil diffusion.

Fay et al. (1971) proposed that the maximum slick area can be related to the volume of the spill by the dimensional formula A in Table A-12.

Fay found that this formula compared well with some recently (1971) summarized field observations.

From Berridge et al., (1968) the equation from Blokker (1964) is listed as equation B in Table A-12.

The ''Blokker'' constants, $K_r$, are derived from the slope of the curves, of the variation of the radius ($r_t^3 - r_0^3$) with time as the oil slick spreads.

The Blokker constants, seen below, were derived from the slope of curves of slick spreading as a function of time for various crude oils.

CRUDE OIL PROPERTIES

| Crude oil | K (about 9° C) | Specific gravity |
|---|---|---|
| Libyan (Brega) | 1,085 | 0.829 |
| Iranian heavy | 750 | 0.867 |
| Kuwait | 1,480 | 0.869 |
| Iraq (Kirkuk) | 975 | 0.845 |
| Venezuela (Tia Juana medium) | 1,340 | 0.869 |

From Murray's analysis of the Chevron spill (March 1970) it is possible to determine the slick length and width of oil from a continuous source as a function of the rate of oil discharge and ambient currents. From one of Murray's graphs, Figure A-4, a spill rate of 2,500 barrels (105,000 gallons) per day with current velocities of 10, 25, and 50 cm/sec (0.22, 0.56, and 1.12 miles/hr) is found to produce slick lengths of 300,120 and 58 km (186, 77, and 36 miles). If it is possible to extrapolate Murray's analysis for the above current speeds, at a discharge rate of 5,000 barrels/day (210,000 gallons/day), the following slick lengths would be obtained: 1,166, 466, and 281 km (725, 290 and 175 miles). The comparable slick widths are given below.

| | 2,500 bbl/day | 5,000 bbl/day |
|---|---|---|
| 10 cm/sec | 11.9 miles (19.2 km) | 23.8 miles (38.40 km). |
| 25 cm/sec | 4.8 miles (7.7 km) | 9.6 miles (15.40 km). |
| 50 cm/sec | 2.4 miles (3.8 km) | 4.7 miles (7.60 km). |

*Case 1 Scenario*

The spill occurs from a platform five to six km from shore directly off an intertidal area which has also been classified as an ''area of special ecological significance''. A drift velocity will be assumed to be 0.8 km/hr. (three percent speed in the area of 28 km/hr.) (USDI, 1972) and the slick will reach shore in about six to eight hours. This velocity is slower than the three to four knots implied by Battelle Northwest (1970) when they cited a Weather Bureau meteorologist who esti-

## TABLE A-10

## Spreading of Oil; Volume Dependent*

| Volume (gallons) | Area<br>Square Meters | Square Miles | Diameter<br>Meters | Miles |
|---|---|---|---|---|
| $3.50 \times 10^4$ | $3.9 \times 10^6$ | 1.51 | $2.24 \times 10^3$ | 1.39 |
| $2.10 \times 10^5$ | $1.5 \times 10^7$ | 5.79 | $4.38 \times 10^3$ | 2.72 |
| $2.61 \times 10^6$ | $9.9 \times 10^7$ | 38.26 | $1.12 \times 10^4$ | 6.98 |
| $4.20 \times 10^6$ | $1.4 \times 10^8$ | 55.82 | $1.35 \times 10^4$ | 8.36 |

* Calculated from Fay (1970).

## TABLE A-11

## Spreading of Oil; Time Dependent*

| Volume (gallons) | Time (hours) | Area<br>Sq. Meters | Sq. Miles | Diameter<br>Meters | Miles |
|---|---|---|---|---|---|
| $3.50 \times 10^4$ | 4 | $9.58 \times 10^3$ | 0.37 | $1.09 \times 10^3$ | 0.68 |
| $2.10 \times 10^5$ | 24 | $1.01 \times 10^7$ | 3.90 | $3.59 \times 10^3$ | 2.23 |
| $2.61 \times 10^6$ | 264 (11 days) | $2.59 \times 10^8$ | 100. | $1.82 \times 10^4$ | 11.31 |
| $4.20 \times 10^6$ | 1,464 (61 days) | $1.10 \times 10^9$ | 426. | $3.75 \times 10^4$ | 23.30 |

* Calculated from Blokker (1968).

Table A-12

# OIL SLICK CHARACTERISTICS

## Oil Slick Area Dimensional Formula A
From: Fay et al., 1971

$$A\ (m^2) = 10^5\ v\ (m^3)\ 3/4$$

Where: A = area

m = meter

v = volume

## Oil Slick Area Equation B
From: Blokker, 1964

$$\frac{(r_t^3 \quad r_o^3) \quad w}{3v(w \quad o) \quad o} = K_r t$$

Where: $r_o$, $r_t$ = slick radius (cm) initially and after time t sec. Assume $r_o^3$ can be neglected in comparison with $r_t^3$.

v = volume of oil ($cm^3$)

t = time of spreading (sec)

w, o = density of water and oil respectively ( g $cm^{-3}$)

$K_r$ = a constant for a given oil

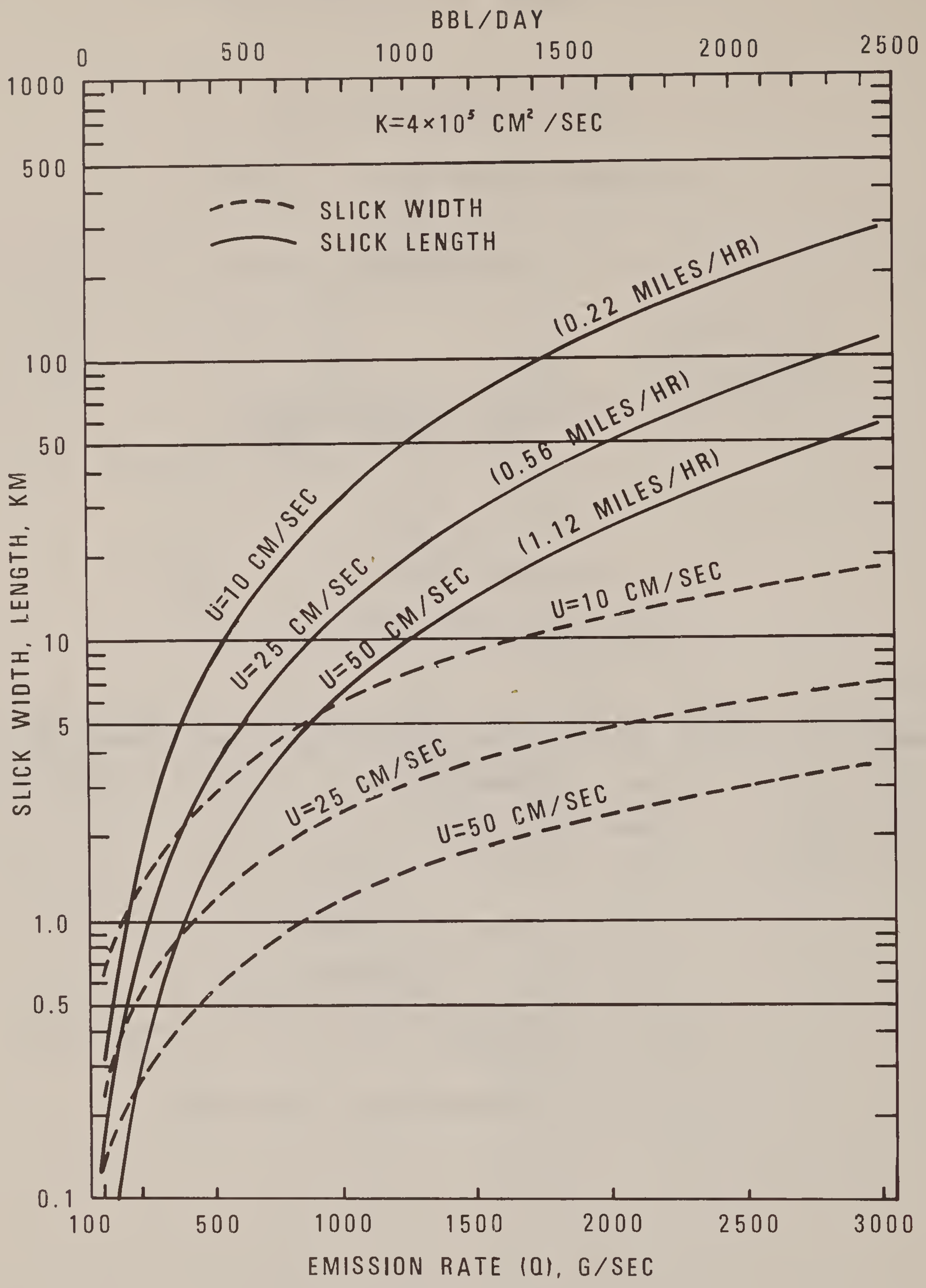

Figure A-4 Slick width (W) and slick length (L) as a function of rate of discharge (Q) for various values of current speed (U).

Source: Murray et al. 1970

mated that downwind oil slick drift ranged from 10 to 20% at the surface wind velocity and stated ". . . instances of skim layer shear were noted with surface oil moving rapidly past nearly stationary free floating debris suspended less than half an inch below the water surface." This assumed velocity is comparable with the experience in the Torrey Canyon during which the oil movement rate averaged 3.3 to 3.4% of the wind velocity.

*Case 2 Scenario*

This is a situation with negligible wind and current velocity which allows the oil to simply float and spread on the water for over a week before it finally goes ashore. As with the Santa Barbara blowout, the oil covers 1,295 square kilometers of open ocean, and does not reach shore until the 12th day when damage to the intertidal area is at a near minimum. A 805 km oil slick would be a very thin film with scattered patches of heavier oil (Allen, 1969).

*Case 3 Scenario*

This spill occurs during a period of maximum land derived sediment inflow which causes maximum oil settlement to the bottom relatively near the source of the spill. We estimate that 30% of the oil spill volume will settle to the bottom. In terms of volume, this is 63,000 gallons (1,500 barrels) after one day, 690,000 gallons (16,500 barrels) after 11 days, and 1.26 million gallons (30,000 barrels) after 61 days. We assume there is little current and wind, the oil spreads in the shape of a circle, and sinks to cover an area of bottom equal to that of the area covered by the surface slick in Case 1 Scenario. The area of bottom covered and diameter of the circle is shown in Tables A-10 and A-11.

## Impact on the Living Components of the Environment: The Gulf of Mexico and Coastal Zone Regions

### Impact on Plankton

Numerous phytoplankton and zooplankton species occur throughout the area of this proposed sale. The northern area of the Gulf of Mexico is similar to other tropical or subtropical bodies of water with respect to plankton composition and biomass (General Gulf, Visual No. 3).

The U.S. Geological Survey (USGS, 1976) estimated that there will be about 682 tons of drill cuttings discharged per each 10,000 foot well. They further estimate that from 25-75 exploratory and 100-300 producing wells may be drilled as a result of this proposed sale, requiring approximately 45-80 days drilling time for each test well and 30-60 days for each development well. In accordance with the code of Federal Regulations, OCS Order No. 7 the drill cuttings will be washed of oil. This mud contains a variety of materials, including waste products from various industrial processes. The basic ingredients of typical drilling mud consist of inert natural materials, i.e., bentonite clay, powdered limestone and barium sulfate. Some additives may contain materials which are not inert. Table A-1 lists ingredients of a characteristic sea water based drilling mud used to drill a typical well in the Gulf.

Since this mud will enter the marine environment through adherence to cuttings, accidents from drilling or overboard spillage from the drilling rig, a localized and temporary impact could occur at the discharge point. Recovery rates would be rapid due to the redistribution of similar species from adjacent areas by currents.

The discharge of drill cuttings and mud will produce temporary turbidity effects in the euphotic (lighted) zone; therefore, underwater illumination will be reduced in the immediate vicinity of the drilling rig. The effects of this activity, immediately adjacent to the drilling area, will be short-lived and highly localized, resulting in a decrease in primary production-photosynthesis by the local population of autotrophic phytoplankton. In addition, some planktonic filter feeding organisms will suffer physiological stress and death. However, both of these effects will not result in any measurable interference with the general level of productivity for each area adjacent to the drill rig. Redistribution of similar species from adjacent areas by currents will offset these minimal effects associated with drill cuttings and recovery should be rapid due to the localized nature of the impact. However, no specific study of this problem has been made.

USGS (1976) estimated that 161 kilometers of new pipelines will result from this proposed sale. Approximately 77% of the 61 tracts offered occur in water depths greater than 61 meters; no burial will be required unless the pipeline crosses the 60 meter contour shoreward for BLM permitted pipelines. If BLM permitted pipelines are needed in the remaining tracts they will be buried. USGS permitted pipeline regulations for burial may be found in OCS Order No. 9. In summary, the Order states that ‘‘all pipelines shall be installed and maintained to be compatible with trawling operations and other uses’’. In areas where pipeline burial would be necessary, it would be accomplished by hydraulic jetting. This would increase the turbidity and the BOD loading in waters in the immediate construction area. Possible resuspension of toxic materials (e.g., pesticides/heavy metals) may also occur in coastal waters.

There may be a temporary decrease in primary phytoplankton production as a result of pipeline burial in offshore waters. This impact would affect local plankton populations, but should not adversely affect the functioning of the total marine ecosystem. The jetting barge is continuously moving while pipeline burial is being completed, therefore only a short time interval is involved and the area of impact is relatively small (approximately a 15 meter wide strip).

Pipeline construction in the coastal zone would have a similar effect on the estuarine species. No definitive study has yet been undertaken on this subject.

Assuming that the formation water would be discharged from the platforms into the Gulf, the following range of values for the denoted parameters have been documented:

| Parameters | Range |
|---|---|
| Oil | 6–827 mg/1 (EPA, 1974). |
| Temperature | 10–60° C (USGS, 1975). |
| pH | 4.5–8.5 (USGS, 1975). |
| Suspended solids | 12–656 mg/1 (EPA, 1974). |
| Settled solids | 0–125 mg/1 (USGS, 1975). |

The volume of water discharged from each platform varies; however, U.S. Geological Survey reported that a total of 322,570 barrels per day of produced water were being discharged as of October 1, 1975.

The resultant thermal, osmotic and chemical (contaminants and oxygen) stresses on indigenous plankton and neuston for offshore waters would probably be confined over a relatively limited area near the discharge point in the euphotic zone of the Gulf in the vicinity of each platform for the duration of production phase. Effects include physiological stress from low dissolved oxygen and high concentrations of dissolved salts. These effects would occur a relatively short distance from the point of discharge, mixing processes would be expected to quickly disperse contaminants, and modify temperatures and salinities of the formation water to levels indistinguishable from that of seawater. Oxygenation of these waters to supersaturated levels would proceed rapidly. An unknown effect could be uptake of water soluble aromatics not removed in the separation process.

No effect from biological waste disposal is expected on plankton. OCS Order No. 8 requires that treated sewage effluent contain no more than 50 ppm BOD, no more than 150 ppm suspended solids and a minimum chlorine residual of 1.0 mg/1. Since the volume of this effluent released per day will be very small, no detectable effect on plankton is anticipated.

A breakdown of tracts offered, show that eighty-two percent of the acreage is gas prone, three percent is oil prone and fifteen percent is oil and gas prone. The probability of a major oil spill (greater than 10,000 gallons or 238 barrels) resulting from this proposed sale is uncertain. However, there has been only 27 major oil spills resulting from the approximately 13,000 wells drilled on the Gulf of Mexico OCS.

Several pertinent studies have been conducted to demonstrate the effects of oil on plankton. It is possible to draw from these studies some general conclusions as to how phytoplankton and zooplankton will be affected if oil is present in the marine environment.

Ray and Mills (1974) and Mills (1974) demonstrated that once an oil spill episode has passed, only a few cells need survive to rapidly repopulate a given area.

The Gulf Universities Research Consortium (GURC, 1974) reported that the total cell counts/liter at the platform were much higher than at the control site.

The number of species of diatoms and dinoflagellates were found not to vary appreciably between the platform and control sites.

The GURC study (1974) also investigated two zooplankton communities in the bay and offshore areas of Louisiana. Neither diversity values nor biomass was significantly different between control sites and production/drilling sites whether in the bay or offshore. There have been no detectable changes in the calanoid copepod fauna of the total population during the past 20 years.

Mironov (1970) indicated that planktonic larvae of benthic and nektonic animals (meroplankton) are more sensitive than mature members of the plankton (holplankton). Therefore a threat to populations of various finfish and shell fish may exist in oil prone areas.

Oil coating of the various surface and actively vertical plankton species (i.e., large coelenterates) could have an adverse affect on planktonic populations (Moore et al. 1973). Neuston, which are strictly surface dwelling plankton, are clearly threatened, and active vertical migrators are potentially threatened.

The above literature indicate that the plankton populations of the Gulf of Mexico ecosystem will probably be able to absorb the impact of a major oil spill and recover rapidly. The greatest number of planktonic organisms directly killed from a spill of greater than 50 barrels would be found in the neuston or communities in the upper five centimeters of the Gulf surface. Since annual biological productivity is greatest in spring and winter, especially along the coast, in areas of upwelling a spill during this part of the year would do the most damage to planktonic productivity and the standing crop.

Impacts to planktonic organisms from chronic low-level discharge include direct lethality, reduction in photosynthetic efficiency, interference with chemical communication and general physiological stress to those organisms which are carried into a contaminated zone for that period of time that they are exposed to hydrocarbon concentrations above the effective level.

The impact from an oil spill could effect various populations of plankton in tracts that are prone to result in oil production. For this proposed sale, the following tracts have been designated as oil prone: 3, 36, 44, 45, 51, 52, 53, 54, 55, 56 and 57.

**Impact on Benthos**

Benthic assemblages and communities which exist in the area of this proposed sale can be broadly described as bay and sound, beach, shallow shelf, intermediate shelf, deep shelf and slope. Within these broad areas, more specific assemblages or communities can be described for shrimp grounds, oyster reefs, sand, silt and clay bottoms, and hard banks. This discussion will include all areas except beaches and hard banks which will be discussed under biologically sensitive areas.

The number of exploratory wells contemplated in this proposed lease sale are between 25-75. The volume of cuttings from each exploratory well of 10,000 feet would be approximately 1,687 barrels and would require about 10 to 14 days drilling; however, wells drilled in hard bottoms may require between 45 to 90 days.

Disposition of 682 tons of cuttings during drilling of each exploratory well will disrupt local benthic environments. Non-mobile benthic forms in the affected area may be smothered. We estimate that in the absence of toxic substances, recolonization of the substrate should begin after one reproductive cycle. The presence of hydrocarbons or drilling muds will retard this recolonization depending on the duration of the presence of hydrocarbons or other toxic materials. Recolonization should commence after a season's duration because of the absence of low concentration of toxic materials in most drill cuttings. If the bottom is different in texture and composition, it may be colonized by other components of the local population resulting in an altered species distribution. This could alter community structure in that part of the food chain which is dependent upon benthic species. This effect however would be highly localized.

We expect that coarser materials would comprise the bulk of the cuttings and possible cuttings mound, and that finer components would be distributed in response to prevailing currents and would grade into natural sediments of the immediate area. Benthic organisms and natural erosional-depositional forces would rework the sediments so that downstream cuttings deposition would be indistinguishable from surrounding sediments. The duration of the impact at each drilling location during and after drilling would be dependent upon: type of disposal; type of cuttings and size of area impacted; seasonal reproduction cycles and recolonization of indigenous species; time for colonization by different species from adjacent area; natural bottom sediment type, and volume of cuttings. A possible adverse effect to benthos might result from the loss of toxic drilling muds due to adherence to cuttings, accidents while drilling or overboard spillage from drilling rig. However, as previously mentioned, only a small percentage of this mud will enter Gulf waters. Because of its low concentration in drill cuttings and the large dilution factor upon disposal, we expect the toxicity to benthic populations to be very localized and temporary at the discharge point.

Oil based muds are seldom used and are not considered in this discussion.

The area to be impacted from the discharge of drill mud and cuttings is dependent upon a number of factors: drill mud compositions and weight; water currents; sea conditions; type of disposal; velocity of materials through disposal pipe; water depth of disposal pipe and size of pipe; type of substrate being drilled or size of particles suspended; size of drill hole and volume of cuttings; geographic location of drilling platforms in the Gulf of Mexico; and dispersion rate of drilling muds and cuttings in water column.

Recovery rates would vary depending on the type and size of population impacted. In general, the initial stages of recovery are characterized by opportunistic species that are often very productive, with a much longer time required to restore the community to one that supports more long-lived species.

In water depths of less than 61 meters, BLM common carrier pipelines and USGS buried pipelines are entrenched by jetting away the sediment beneath the pipe and allowing the pipe to settle into the underlying trench approximately one meter. Partial burial takes place quite rapidly as the disturbed sediments slide and settle back into the trench.

The jetting process physically disrupts the sediments in its path and also causes resuspension of large quantities of sediment. This process would have the effect of displacing benthic organisms and would result in direct mortality to softer life forms, and indirect mortality to other through increased vulnerability to predators. Although recolonization would begin immediately, the native fauna could not be fully restored until seasonal reproduction cycles had been completed by representative species from adjacent areas; these would provide a supply of larvae to settle and enter the disturbed substrate.

Turbidity resulting from resuspended sediment is capable of producing an adverse impact on filter-feeding molluscan and crustacean benthos populations by clogging the filter-feeding apparatus or blocking respiratory surfaces. This impact is temporary, occurring during burial operations and lasting from several hours to a few days, and would effect those populations adjacent to the pipeline. Casual observation has revealed that ocean currents carry the sediment and redeposit it at various distances, depending upon the particle size of the sediment. Moreover, these same factors, along with the rate of the burial operation, determine the length of time in suspension.

Another possible source of impact during pipeline dredging is the resuspension of toxic heavy metals, hydrocarbons and pesticides that may have been deposited in the area by polluted rivers and/or land runoff, but the predictions for the occurrence, location, scope and duration of the impacts are unknown. The possibility exists that these toxic materials could be ingested by lower marine life and could then be magnified through the food chain until they would accumulate in serious quantities in top carnivores, including those species harvested for human consumption. However, the likelihood that this impact would occur decreases with distance offshore due to the distance from polluted rivers and/or land runoff.

Beyond 61 meters exposed pipelines will provide a hard substrate that will be quickly colonized in much the same way as platforms are colonized. This will result in a wider variety of organisms and greater biomass available for input into the food chain from settlement and growth of sessile epibenthos (fouling organisms). They will also act as shelter for more susceptible organisms or benthic larval forms.

Approximately 161 kilometers of pipeline may be required to transport oil/gas production from wells developed from this proposed sale. Locations of these pipelines are unknown. We expect that the area impacted is localized within 15 meters of the particular operations throughout the water column. However, this area may decrease or increase because of the following variables: water currents, sea conditions, water depth, natural bottom sediment and dispersion rate of bottom sediments from jetting operation.

Recovery rates would be dependent upon seasonal reproduction cycles and recolonization range from months to several years.

No effect from biological waste disposal is expected on benthic organisms. Since the volume of this effluent released per day will be very small, no detectable effect on benthic organisms is anticipated.

Assuming that the formation water would be discharged from the platforms into the Gulf, the following range of values for the following parameters have been documented:

| Parameters | Range |
|---|---|
| Oil | 6–827 mg/l (EPA, 1974). |
| Temperature | 10–60° C (USGS, 1975). |
| pH | 4.5–8.5 (USGS, 1975). |
| Suspended solids | 12–656 mg/l (EPA, 1974). |
| Settled solids | 0–125 mg/l (USGS, 1975). |

These effluents will affect only surface and near-surface organisms and will have no impact on benthic organisms at the point of discharge because of the high dilution factor upon entering the Gulf.

Of the tracts nominated, 82% are gas prone, three percent are oil prone and 16% are oil and gas prone. The probability of a major oil spill resulting from this proposed sale is unknown as statistical data reflecting current technology is outdated. Other sources for oil spills are chronic low level leakage from production platforms and pipeline leakages.

The following is a synopsis of pertinent studies that have been conducted concerning the effect of oil on benthic organisms. These studies include both field and laboratory investigations. Thus, it is possible to draw from these studies some general conclusions to how benthic organisms will be affected if oil is present in the marine environment.

For discussion purposes, benthic fauna can be divided into; gastropods (snails, limpets, etc.), bivalves (oysters, clams, etc.), crustaceans (shrimp, crabs, lobsters, etc.) and all other fauna (worms, anemones, etc.). Apparently, gastropods are the most resistant to the toxic effect of petroleum and crustaceans are the most sensitive (Moore, et al., 1974).

Most gastropodal studies indicate a rather high resistance to hydrocarbon toxicity and periwinkles (*Littorina littorea*), a common intertidal snail, are apparently very resistant. The critical concentration may be 100-200 ppm or more. Limpets (*Patella vulgata*) demonstrate the only significant deviation and appear to have a critical threshold concentration of less than 5 ppm. The relatively high resistance of most gastropods may be due to secretion of a protective mucous substance (Shelton, 1972).

Bivalves, including oysters, clams, cockles and mussels, are moderately resistant to oil. The ability to close their shells and seal off the ambient water mass acts as an effective protection mechanism. However, this closed condition cannot be maintained indefinitely; in fact, cockles tend to "gape" making them more susceptible (Simpson, 1968). Typical critical concentrations for most bivalves are 5-50 ppm of petroleum hydrocarbons.

Both benthic crustaceans and other miscellaneous benthic organisms are apparently fairly sensitive to petroleum hydrocarbons. Threshold concentrations appear to lie as low as .4 ppm of petroleum hydrocarbons. Bender, et al. (1974) used a continuous flow system for 48 hours where a mechanically mixed oil and water solution was used. Using Bunker C fuel oil, he found that $TL_{50}$ for a crustacean, *Gammanus mucronatus*, was 0.42 ppm, and $TL_{50}$ for the hermit crab, *Pegarus longicarpus*, was 0.62 ppm. Burrowing organisms may also be threatened by alteration in the substrate texture and structure.

On incorporation of hydrocarbons by benthic fauna, Blumer (1969) and Blumer, et al., (1970a) have indicated that bivalves exposed to oil may retain aromatic hydrocarbons for a period of months or perhaps indefinitely. However, Lee, et al., (1972a) demonstrated that the mussel Mytilus edulis accumulated several different petroleum hydrocarbons but released approximately 95% of these in a period of two weeks when returned to uncontaminated water. Lee and Benson (1973) stated that petroleum hydrocarbons resulting from a distant small spill were accumulated by Mytilus but members of the same population showed no contamination three weeks after the spill. Teal and Stegeman (1973) exposed oysters to 106 ug/liter of a No. 2 fuel oil for periods of up to 50 days. They found that short term accumulation was correlated with the fat content of the oysters. The maximum levels of hydrocarbons detected in oyster tissues were 334 and 161 ug/g wet weight for high and low levels in oysters, respectively. After one month in their post-exposure "cleaner" sea water system, the oysters still retained approximately 34 ug/g total petroleum hydrocarbons, but since there was a small amount of contamination in this system (11 ug/liter), continued low level accumulation could not be ruled out.

In addition, Anderson (1973) reported that oysters quickly purged themselves of oil when placed in oil-free seawater. This investigator used four different oils (South Louisiana crude oil, Kuwait crude oil, No 2 fuel oil and Bunker C oil) and two different oysters (Pacific and American oyster, *Crassostrea virginica*). Anderson, et al., (1973) also reported the same results for brown shrimp (*Penaeus aztecus*) and the sheepshead minnow (*Cyrprinodon variegatus*) using identical methods. Vaughan (1973) also reported that oysters quickly purge themselves of oil when exposure terminates and they are placed in non-contaminated seawater.

Corner, et al. (1973) observed that naphthalene is quickly detoxified and excreted by the spider crab (*Maia squinade*).

Coating effects are principally associated with the higher boiling point fractions of oil (for example, oil which has been weathered so that the more toxic fractions have evaporated). The effects are usually in the intertidal zone involving both organisms and substrates. The thickness of coating which causes mortality is not readily definable. Most species exposed to a coating of weathered crude oil are likely to be affected in some manner (Moore, et al., 1974).

The effects of habitat alteration or removal of species from an area involves intertidal and subtidal benthic species. Epifauna (species lying on the substrate) may be little affected by the physical presence of oil; however, infauna (species living in the substrate) can be expected to be more vulnerable to habitat alteration. Unfortunately, there is virtually no data on the relationship between the amount of oil present and the degree of suitability of the substrate for various species (Moore, et al., 1974).

Based on geographic locations of oil prone tracts for this proposed sale, and using classifications of benthic communities of Parker (1960) for offshore Texas and Louisiana, the following are areas with the highest potential for impact on benthic assemblages from spilled oil. Adjacent areas could also be impacted if the spill was not contained or cleanup procedures were inadequate.

In addition, bottom sediment (Western and Central Gulf, Visual No. 3) are listed to help characterize the assemblage.

These assemblages include:

High Island—one oil/gas prone tract, silty sand.
South Marsh Island—one oil/gas prone tract, Inner shelf, clayey silt.
Eugene Island—two oil/gas prone tracts, Outer shelf, silty clay.
Ship Shoal—two oil/gas prone tracts—Intermediate shelf, clayey silt.
South Timbalier—one oil/gas prone tract, Intermediate shelf, silty clay.
West Delta—two oil/gas prone tracts, Inner shelf, Clayey sand and silty clay.
South Pass—one oil prone tract, Intermediate shelf, silty clay.
Main Pass—one oil prone tract, Intermediate shelf, clayey silt, silty clay and silty sand.

In the event of a large oil spill, certain benthic assemblages will be affected because of the water depth and associated turbidity of these waters. These primarily include the inner (shallow), intermediate (middle shelf I) shelf assemblages and intertidal or shoreward areas if oil reached the shore. The seaward assemblages are less likely to be affected due to dispersion and dilution of crude oil through the water column. Also, quick response clean-up procedures (i.e., skimmers and containment of an oil spill) will reduce the area impacted thus reducing the probability of oil reaching intertidal benthos. In the history of OCS leasing in the Gulf of Mexico no oil spill resulting from an OCS lease area has ever penetrated semi-enclosed embayments, estuaries or wetlands. Beaches will be discussed under biologically sensitive areas.

The recovery of contaminated areas varies greatly for benthic populations. Variables include flushing of the contaminated area, type of bottom sediments, the degree of isolation of its ecosystems and the kinds of organism that form them.

In summary, impacts resulting from: (a) Drilling will cause smothering and burial (especially near bottoms firm enough to support an epifaunal community) in the immediate area of drilling operation. Recovery will usually begin within months but biological recovery will not be complete for the epifaunal communities for at least several years. (b) Pipeline burial will result in community disruption and destruction in the path of the 81 to 161 km of pipeline corridor construction. Destruction will be minor except in depths of less than 61 meters. Even here destruction will probably be limited to a strip about 30 meters wide along the pipeline path. Recovery will be in a matter of days for the mobile benthic organisms and one to several years for sessile organisms. (c) Resuspension of polluted sediments will result if pipeline laying or drilling operation occurs by the outfalls of polluted bays, rivers or streams. Direct kill to benthic organisms will be of limited but unqualifiable extent and duration. Pesticides could be accumulated in the food chain as the result of drilling or pipeline burial in these areas. This could be detrimental to certain individuals at the top of the food chain, although no widespread population fluctuation will result from these operations. (d) A large oil spill with a maximal amount of sinking oil would be the most detrimental to subtidal benthos. Since the literature indicates oil spills cause a range from extensive destruction to slight or undeterminable amounts, it may be concluded that some destruction will occur as a result of a massive oil spill. (e) Chronic low level oil pollution also would affect benthic communities, to what extent has not been determined, because no long-term field studies have been performed.

**Impact on Nekton**

Five taxonomic categories represent the active swimmers or nekton for the Gulf of Mexico: marine mammals and reptiles, fishes, cephalopod molluscs and certain crustaceans, shrimp and swimming crabs.

Moore, et al., (1973) hypothesized three mechanisms by which oil may impact the individual fish (nekton) and thus the size and distribution of fish populations. They are:

Egg and/or larval mortality on spawning and/or nursery grounds. Eggs and larvae may be affected by concentrations of soluble aromatic hydrocarbons in excess of 0.1 ppm.
Adult mortality or failure to reach spawning grounds if the spill occurs in a confined, narrow or shallow waterway necessary for migration or spawning. Anadromous (spawns in fresh water) fish crowding into an estuary would seem especially vulnerable to this hypothetical case.
Loss of local breeding population or ability to breed due to contamination of spawning ground, or the destruction of the nursery area by oil.

Adult forms of nektonic organisms will avoid areas of contamination from oil as a result of their locomotive ability (Nelson-Smith, 1973). Another study by Roberts indicates that although nekton may be the most dense in the impact zone in comparison with other depth zones, the densities are so small as to prevent recognition of a direct kill. In such a case, avoidance is not involved; however, the effect is the same with little or no impact.

The probability of a massive spill resulting from operation on the OCS impacting spawning or nursery areas will be minimal because of the low number (11) of oil prone tracts for this proposed sale, distances of tracts from shore, and the fact that in the history of OCS leasing in the Gulf no oil spill resulting from an OCS lease area has ever penetrated semi-enclosed embayments, estuaries or wetlands.

The occurrence of sublethal (i.e., masking or interfering with prey detection, reproductive patterns, social behavior) effects are uncertain, but have the possibility of being an important impact of oil production in the marine environment. Studies conducted to date indicate that the severity of these impacts is uncertain (National Academy of Sciences, 1973).

Drilling operations (i.e., discharge of drill cuttings and mud, and toxic material) will have a temporary impact effect on bottom-dwelling fishes or nekton (GURC, 1974).

GURC (1974) reported that drilling rigs have a disruptive effect on bottom fishes as compared to control areas. In shallow water areas, in Timbalier Bay, drilling operations had a very pronounced effect on the presence of the majority of the species in the area, such as: Groupers and king whiting. The fish species temporarily moved out of the vicinity of the drilling operations. This was also true offshore but to a lesser extent. This adverse effect is obviously localized and temporary as evidenced by the fact that the makeup of the area's fish populations has not changed since the oil drilling began.

This temporary disruptive effect will exist for pipeline placement and burial. These organisms will be exposed to increased turbidities and BOD, and possible resuspension of toxic materials.

No impact from biological waste disposal is anticipated due to the small amount discharged.

Another impact resulting from the placement of exposed pipelines and production platforms is that they serve as artificial reefs. They provide: Food in the form of encrusting algae, bryozoa, crustaceans and sponges; shelter in the various nooks and crannies, where juvenile fishes can escape predators; and visual orientation. Although orientation is not fully understood, the physical presence of objects in open water is widely acknowledged to attract many species of fish such as: Groupers and red snapper.

Dr. J. B. Thompson, investigating for the Gulf Universities Research Consortium (GURC, 1974), found no evidence of either harmful or beneficial effects on the fish and shellfish fauna on the open shelf as a result of the placement and maintenance of the offshore oil platforms. His study included the most abundant bottomfish trawl fauna of north central Gulf of Mexico, located between longitudes of 89°30′ N. and 92°30′ W. in depths of 18 to 137 meters, across the continental shelf off the coast of Louisiana. The dominant species studied included croaker, spot, scup, cutlass fish, sea catfish, sea trout, ground mullet and lipid fish. Dominant invertebrates included offshore blue crabs and brown and rock shrimp. Dr. Thompson used data from the Bureau of Commercial Fisheries (now the National Marine Fisheries Service), gathered by the M/V Oregon and other chartered vessels during the period 1950-65. This period saw the rise of the offshore oil industry in the study area. Dr. Thompson also stated that no trends were apparent throughout the period in either quantity or distribution of species studied. He also found a general trend toward diminution of trawl catch from east to west across the study area, which he attributed to current patterns and bottom type differences.

In summary, data thus far accumulated do not indicate negative impact on nekton from the placement and maintenance of the offshore oil platforms.

**Impact On Food Webs**

A majority of hydrocarbons do not accumulate in the food web; this is indicated by the fact that organisms have the ability to depurate at least a majority of these hydrocarbons. However, the possibility exists for the build up in organisms of selective hydrocarbons and non-hydrocarbon components that occur in oil. Substances such as naphthalenes and benzopyrene have been found to accumulate in mollusks in a relatively short time. Although accumulation can occur, magnification does not occur; however, greater than normal levels of aromatic hydrocarbons could be passed on the next tropic level. The impact on the predator is unknown, but it would depend upon the concentration in the prey, frequency of consumption, and the type of hydrocarbon within tissues of the prey.

There is ample evidence which indicates that heavy metals accumulate in the marine food web in a variety of organisms at the various tropic levels and through a variety of uptake pathways. The concentration factors reflect the abilities for marine organisms to concentrate elements from very dilute solutions in sea water.

Magnification of heavy metals such as cadmium occurs because they are relatively resistant to chemical and biological degradation. Most of the incidents of high levels of heavy metals found in marine organisms in the ocean occur in coastal waters and point sources near pollution sources from land. The toxic effect on a consumer can result from feeding on organisms further down in the food web that have an effect on that organism.

Studies by Windom et al., (1973) indicate that copper, cadmium and zinc concentrations were similar in all fish studied except for the small plankton- eating fish (anchovies, etc.) which had much higher concentrations of these metals. This indicates that these metals are depleted up the food chain rather than magnified.

Evidence has been presented which shows that heavy metal concentrations in petroleum, formation water and drilling fluids can range from 10 to $10^5$ times the natural background levels of the open ocean. These materials are diluted in seawater and can be absorbed by some marine organisms to various degrees. Therefore, there could be some uptake of metals especially by the sessile organisms around the platform. It is not known to what extent this occurs and to what level the heavy metals become concentrated. Benthic invertebrates are an important food source in both larval and adult forms. Therefore, their position in the food web makes them an important source for contaminants.

The input of heavy metals to the marine environment and accumulation in the food web due to offshore petroleum operations should be far less significant than sources of heavy metals from land in the coastal waters such as sewage effluent. Since the effects of heavy metals input from offshore petroleum operations into the marine food web are unknown.

### Impact on Biologically Sensitive Areas

For the purposes of this section, biologically sensitive areas for this proposed sale area include shoreline and underwater banks.

#### SHORELINES

Shorelines in the Gulf range from sandy to muddy, except for small and widely scattered pilings and jetties. Impacts on the shoreline could result from contamination by spilled oil.

The construction activity expected for the proposed sale may require new pipelines to transmit oil and/or gas to onshore facilities. Eighty-two percent of the tracts are estimated to be solely gas prone with three percent estimated as oil and the remaining fifteen percent as oil and gas.

During pipeline laying operations, pipelines are buried by jetting up to a point in which the jetting barge would be in danger of shoaling if further progress was made. From this point on, the pipeline is usually buried by use of a suction, clamshell or bucket dredge. As this operation crosses the beach, it will disrupt and rework the substrate for a width of approximately nine to twelve meters.

Another possible source of impact during pipeline dredging to shorelines is the resuspension of toxic heavy metals and persistent pesticides that may have been deposited in the area by a polluted stream and land runoff. The possibility exists that these toxic materials could be ingested by lower marine life, and then be passed through the food chain, to higher forms of life, including man.

Rutzler and Sterrer (1970) have pointed out that sandy shorelines (beaches) have a horizontal rather than vertical extension and a large ''internal'' surface. Therefore, they act as high natural filters for the water transported in by waves and tides. In the case of an oil spill, large quantities of oil will be pressed into the sand, mixed with the subsurface return flow and then transported to other areas. Rutzler and Sterrer (1970) found a large apparent decrease in the total number of species present in oiled sands, although they were unable to prove that this was a result of spilled oil due to a lack of baseline data.

During the Arrow spill study (Operation Oil, 1970), excavation of clams revealed oil extending down most burrows and often forming a pool at the bottom. Clams generally moved up the burrow to evade the pools, and sometimes left the entire substrate. Some mortality occurred and even the live clams were morbid, although they recovered with prolonged exposure to air.

Mackin (1973) stated that the effects of oil in the intertidal zones, beaches, marshes and rocky shores are sometimes severe. The area of the beach zones is subject to heavy concentrations of oil and may be damaged if certain levels are reached.

In the event an oil spill reaches a piling or jetty, damage to the benthic community is expected. Damage would depend on the level of concentration of the crude oil.

In summary, if oil were to be deposited on the moderate or low energy shoreline of the Gulf of Mexico, there would probably be a substantial kill of infauna. Removal of oil by natural means would probably be a very slow process and would require redistribution of the sand by storm tides and high-energy storm surf. Recovery rates would range from months to years depending on reproduction cycles, recolonization and extent of contamination.

Once a spill arrives ashore, it is generally too late for complete and instantly effective mitigative measures, and the cleanup operation itself may have unfavorable impacts.

Four oil prone tracts (54, 55, 56 and 57) located around the Mississippi Delta may have the highest probability of causing damage to shorelines through accidental oil spills.

### Reefal features

Three tracts, 10, 11 and 61 contain all or part of an offshore fishing bank.

We have proposed that these tracts be offered with protective environmental stipulations (see Mitigating Measures Included in the Proposed Sale) promulgated for other fishing banks. These stipulations specify requirements for the protection of fishing banks which must be satisfied before any drill sites, pipelines, rigs, platforms and any other development operation will be approved.

We feel that these stipulations are adequate for protection of these banks from direct adverse impact. However, the potential for long term, indirect impact from drilling and production operations on such features as reefs and banks is insufficiently known to allow prediction at this time.

## Impact on Vegetation

This section will treat only that vegetation in the coastal area which may be affected by an oil spill from a well or pipeline. This includes only those environments that are inundated regularly or periodically by tidal action which may expose the vegetation to pollutants.

There is approximately 175 km of coastal marshland along the Mississippi Delta region that is subject to impacts resulting from sporadic accidental oil spills, from chronic oil pollutants, and from pipeline construction. Tanker operations are not expected to result from this proposed sale. Therefore, accidental oil spills will be related to oil washed ashore from platform accidents or pipeline ruptures.

Numerous papers have treated the effects of a single oiling on emergent marsh plants. These reports discussed marshes located in several different regions of the world; however, the general vegetative groups are similar and most are of the same genera. Thus, it is possible to draw from these studies some general conclusions as to how certain plant genera will be affected by potential oil spills.

Fuel oil spills at West Falmouth, Massachusetts and Chedabucto Bank, Nova Scotia, resulted in severe damage to many marsh organisms as reported by Burns and Teal (1971) and Thomas (1973), respectively. The plant most severely affected was the cordgrass Spartina, a perennial plant that plays an important role in aeration, sediment stability and nutrient recycling in marsh ecosystem. In the Chedabucto Bay spill, the heavily oiled areas showed very little recovery of Spartina after two years.

Less attention has been given to chronic pollution within the marsh environment. Baker (1971b) provided some data on this subject. In an experimental marsh area, test plots were subjected to oilings at various intervals. In general, recovery from up to four oilings was good, but above this amount, there resulted a rapid decline in vegetation. This tolerance varied some by different plant species. Baker also believed that marshes could probably survive two or three oilings a year, provided that a long recovery period followed.

More insidious effects can be expected in areas of chronic pollution. Studies by Nelson-Smith (1973), Baker (1971b) and Crapp (1971) on the salt marshes of South Wales showed that refinery discharges, even if in low concentration (10 ppm), will in a matter of a few years, because of its continuous flow over extended periods of time, kill all the vegetation in the affected area. The damage to Spartina is caused by the accrual of oil on the surface of the leaves which prevent the transfer of oxygen within the plant tissue, thus resulting in severe oxygen depletion around the roots. The killing of Spartina led to the subsequent erosion of the marsh and the loss of a portion (38 hectares in the Nelson-Smith study) of the marsh habitat.

In general, there are many variables involved (oil type and amount, season of the year, cleaning treatment and species of plant) that influence the degree to which marsh vegetation will usually recover from acute oilings with adequate recovery time. The possibility for serious short-term (less than one year) impacts to the marsh vegetation is possible in the event of an oil spill resulting from this proposed sale.

Five of the oil prone tracts included in this proposed sale are in close enough proximity to the coast that they could allow an oil spill or chronic pollutants to enter the marsh environment. These include tracts 3, 54, 55, 56 and 57.

Gagliano (1972) has identified several adverse impacts to marshes as a result of pipeline canal dredging. These include primarily the disruption of marsh vegetation, salt-water intrusion, accelerated run-off and increased tidal exchange. Any one of these impacts have the potential to reduce a marshes' productivity or to alter the floral and faunal components. The duration would be short-term (less than one year) if the area is rehabilitated upon completion of the pipeline. However, a long-term impact could result if no effort at reclamation is made. The impact to marsh habitat could be permanent, for example, where drainage of wetland might occur due to the "ditch-effect" of the pipeline canal.

The extent to which an area's ecosystem may be influenced is partly dependent upon the number and location of pipelines coming ashore, and the recovery of the right-of-way after completion. Generally, it is advantageous for industry to utilize existing pipelines whenever possible in order to reduce expenses and also to eliminate unneeded disturbance of resources. From the estimated 20-40 platforms that may be generated as a result of this proposed sale, 161 kilometers of pipeline are estimated to be required. It is anticipated but now known that production from this sale proposal will be connected to existing facilities and the probability of pipelines coming ashore is remote. Therefore, no adverse impacts resulting from transportation of crude oil or gas, storing, and refining activities would be incurred to marshes, either immediately or cumulatively, should this proposed sale proceed.

### Impact on Wildlife Species

#### BIRD SPECIES

Considerable data are available concerning the impact of oil on various species of birds. According to available data, it appears that birds generally suffer the same physical and physiological symptoms when contaminated with oil as other fauna. Therefore, mortality and damage to bird species, as described by Bourne (1968), can be expected for those fauna which have been coated with oil. Hydrocarbon contamination destroys the insulation and waterproofing ability of the affected birds' plummage. Not only is the bird subject to heat loss and pneumonia in this condition, but it may also lose buoyancy. In addition to the external effects, internal disorders can result from ingestion of the oil during preening or feeding.

Menzies (1973) summarized 42 oil spills exceeding 50 barrels in the Gulf of Mexico between 1964 and 1973. No indication of any bird losses were noted, although it is possible some loss may have gone unreported since Clark (1973) reviewed several papers that suggested that less than 25% of bird corpses ever reach shore if killed at sea. Based on the above information in addition to the low probability of a large oil spill, this proposed sale should not adversely effect pelagic birds; however, this possibility cannot be entirely ruled out.

Bourne (1968) discussed the probability of certain groups of birds being more susceptible to becoming coated with oil than others. He believed that aerial species would not deliberately dive into the oil and that coastal species may paddle over or squat in oil on the shore, but they would receive minimal damage. It was suggested that swimming species were the most vulnerable since they would probably not notice the oil until they swam into it. The latter would include many of the waterfowl group.

Shore birds (gulls, plovers, etc.) by nature spend a good part of their daily activities feeding and resting on the beach or shore environment. The effects of oil on shore birds has been documented by numerous investigators. Straughan (1970) and Drinkwater, et al., (1970) reported the impact of the Santa Barbara oil spill on bird life. Their data indicated that during an oil spill shore birds faired much better than some other groups of birds closely associated with the marine environment. From mortality figures on 432 birds, less than 20 were classified as shore birds.

Hartung and Hunt (1966) investigated the impact of oil ingestion by waterfowl in addition to the effect of their physical contact with oil. It was determined that lethal doses of lubricating oil ranged from 1 ml to 4 ml per kilogram of body weight. Therefore, a duck that acquired a coating of seven grams of oil and preened about 50% of this could easily ingest a lethal quantity. A definite correlation cannot be made concerning the relationship between the waterfowl death and the lubricating oil and crude produced in the Gulf of Mexico. However, it is presumed that sufficient quantities of ingested crude would cause death. The probability of this cannot be estimated; however, in reality, the chance of this occurring is considered low.

External effects of oil are not the only detrimental impact possible to birds. Hartung (1965) demonstrated that duck eggs treated with 2036 mg of medicinal oil (presumably non-toxic) indicated a hatchability of 20% as against 90% in controls. In addition, none of the 19 eggs incubated by those ducks which were smeared with oil on their undersides hatched. Ingesting oil-contaminated food also halted laying and suppressed reproductive behavior. Rittinghaus (1956) reported an incident in which the eggs of numerous terns and other shore birds failed to hatch after the parents had become contaminated with oil.

The possibility does exist for significant damage to occur to marsh and shore birds should an oil spill reach the shore and contaminate the birds or their habitat. In view of the distance from shore in which most of the oil prone tracts are located, this possibility is significantly reduced. However, there are five oil prone tracts (3, 54, 55, 56 and 57) that are close enough to shore to pose a threat to nesting birds should an oil spill occur.

Indirect impacts to shore and marsh birds could include temporary loss of habitat due to pipeline construction, and permanent loss due to the construction of onshore facilities. This impact is also felt to be improbable since no new refineries are anticipated and most, if not all, new production from this proposed sale will come ashore in existing pipelines; therefore, no impact is anticipated from refining construction.

### COASTAL/AQUATIC MAMMALS

A review of the current related literature indicates that there has been little research of the effects of acute doses of crude oil on mammals and other species inhabiting marsh habitats. Peller (1963) and Wragg (1954) observed various oilings of muskrats and beavers. Generally, the insulating properties of the fur of aquatic mammals can be expected to be destroyed upon being coated with oil, and later results in illness or death.

Nelson-Smith (1973) stated that since mammals have an impervious skin and breathe air, opportunities for toxic components of oil or emulsifiers to exert a physiological effect are largely limited to their ingestion during preening, grooming, and perhaps feeding. Irritation of the eyes or exposed mucous membranes may also be common to contaminated individuals.

In view of the general proposal of this sale, the probability that an oil spill will reach shore is considered remote. However, five oil prone tracts (3, 54, 55, 56 and 57) which are close enough in proximity that an oil spill could reach shore and create an adverse impact to wildlife species.

### MARINE MAMMALS

The further development of this Gulf of Mexico lease will possibly affect some 25 species (Sect. II.E.4) of marine mammals.

While published information on marine mammals in the Gulf of Mexico is scant, Brownell (1971) and Le Boeuf (1971) investigated the effect on marine mammals of the Santa Barbara oil spill. Numerous dead animals found after the spill, including grey, sperm and pilot whales, dolphins and elephant seal pups, were examined histologically and chemically for the presence of oil or pathological effects related to oil. No such oil or pathology was found and the deaths were attributed to natural causes. It was also noted that the number of deaths was not abnormally high. However, Connell (1973) analyzed the data of Brownell and Le Boeuf (1971) on the mortality of sea lion pups and showed dead pups had more oil on their bodies than one would expect by chance.

Fifteen species of cetaceans (Section II.E.4.) including six endangered species (black right, humpback, fin, sperm, sei and blue whales) have been sighted in recent times in the Gulf of Mexico. There is, however, little information on the life histories of cetaceans in the area. While many cetaceans commonly travel in groups, limited data on regional occurrences may indicate that only individuals would be impacted by oil spills as a result of the proposed Gulf of Mexico sale.

A potential danger to cetaceans is the sorbtion through or on the mucus membrane lining of the blow hole distal to the nasal plug. This area remains open near the water surface and may become oiled. The ultimate outcome of oil exposure could be a thin oil film covering of the lungs and respiratory passages which has the same effect as pneumonia including death. There were no reported sightings of dead whales following the Santa Barbara oil spill.

As cetaceans forage for such organisms as copepods, euphasiids and fish, localized decreases or redistributions of these organisms as a result of OCS activity could limit food availability for cetaceans. Ingestion of contaminated organisms as a result of an oil spill incident could occur.

While young cetaceans might also ingest oil during their period of lactation, other effects of hydrocarbons upon mating, implantation, pregnancy, placentation and parturition are unknown for cetaceans.

Data are not available in the Gulf of Mexico to estimate the impact of offshore production on marine mammals. However, the impact would appear to be a function of the probability of an oil spill and the population size and distribution of the species. Such should be the case of a healthy population of marine mammals such as the bottlenosed dolphin or the spotted dolphin which are the most common marine mammals and the short finned pilot whale, the most common of the larger marine mammals. However, because these animals are not abundant in the Gulf of Mexico, their chance of exposure to oil pollution is reduced.

However, in the case of endangered species of marine mammals, such as those listed in Sections II.E.4. and III.B.8., any contamination by oil of an individual and the subsequent harm incurred would be detrimental to the population of that mammal.

### UPLAND WILDLIFE

No direct impact is anticipated to Upland wildlife as a result of this proposed sale. However, there may be an indirect impact as a result of habitat loss, should an onshore storage facility be constructed. While some species could emigrate to other suitable areas, many species could not do so because of competition with resident species in adjacent areas. Many marsh areas are presently being utilized to their full capacity by resident upland wildlife.

### Impact on Endangered Species

Several endangered species occur within or in close proximity to the proposed sale area. The following discussion will treat those species classified as ''endangered'' by the U.S. Fish and Wildlife Service and are depicted on Visual No. 4 of the Western and Central Gulf.

A small breeding colony of Brown Pelicans (50 pairs) has been established on Grand Terre Island, Louisiana, and appear to be making a comeback as a resident population. The Brown Pelican wintering population enjoys a wider distribution through the central Gulf. Two nesting rookeries are also identified along the Texas coast (Western Gulf, Visual No. 4).

Possible impacts on the Brown Pelican as a result of offshore leasing include the possibility of becoming contaminated with oil, and ingesting oil-contaminated food. Since this species does depend totally on the marine environment, the possibility of it becoming oiled or ingesting oiled food organisms is a possibility in the event an oil spill does occur in close proximity. However, for this proposed sale the nearest oil prone tract (54) is approximately 16 km from shore, therefore the chances of oil impacting the birds or their habitat is low. It is not expected that an occurrence of this nature would be detrimental to the total population in the State, since the Brown Pelican does not spend all of its time in the water and is not constantly exposed to pollutants. Any bird that would contact the oil, however, would be susceptible to illness or death.

The possibility for consuming oil contaminated food organisms is a very real possibility since the pelican feeds on fish species. No data is available concerning single or accumulative doses of petroleum derived hydrocarbons. A massive dose could result in death.

The red wolf inhabits the coastal prairie in southeast Texas and southwest Louisiana. No direct impacts to the wolf are anticipated from offshore leasing.

The alligator, for all practical purposes, inhabits the entire coastal area of the Central Gulf. They are primarily a species of the fresh water environment, but occasionally inhabit brackish marshes.

The alligator depends upon well established marsh habitat for its supply of food species and for successful nesting. If the marsh inhabited by alligators is devegetated by an acute oil spill, the alligator population may be adversely affected to a degree dependent upon the time required for reestablishment of marsh vegetation.

Sea turtles in the Gulf include the Atlantic ridley, hawksbill, leatherback. The principal impact that may affect the turtles as a result of offshore leasing is oil washing ashore and possibly contaminating the eggs or hatchlings. Both of these possibilities are considered remote, since the eggs are generally well covered with sand and the hatchlings are exposed for only a very short time to the beach environment once they emerge from the shell. Any loss that would occur may seriously reduce future nesting populations. Individual turtles could be coated with oil if they emerged into an oil slick, however, this would also be a remote possibility. Leasing as a result of this proposed sale would not affect the sea turtle population on an cumulative or immediate basis.

The southern bald eagle, also not shown on Central Gulf, Visual No. 4 maintains a fragile nesting population in coastal Louisiana. The location of these nesting sites are not in the vicinity of any oil prone tracts for this proposed sale, therefore, no impact is expected.

Several species of endangered marine mammals inhabit the area of the proposal. They are the black right whale, the sei whale, the blue whale, the fin whale, the humpback whale and the sperm whale. These animals are susceptible to impacts for oiling, noise, food resource depletion, behavioral and reproductive disruption, and boat-animal collisions. These populations will not benefit from this proposal but will only suffer as a consequence.

### Impact on Commerical Fisheries

Offshore oil and gas operations interfere with commerical fisheries in the following ways: removal of sea floor from use; underwater obstructions; oil pollution (chronic or accidental); pipelines and reefs (man-made and natural). Probably the commercial fisheries most affected would be menhaden and/or shrimp trawling in the nearshore areas.

#### NAVIGATIONAL CONFLICTS

This impact involves navigational problems to commercial fishing fleets and reduces the area of sea floor for trawl fishing. Since the majority of shrimp and commercial bottom fish are caught by dragging large trawls across the sea floor, sites occupied by drilling or production platforms and attendant service boats and barges must be avoided. If the structures are jack-up drilling rigs or permanent production platforms, the area of the sea floor removed would amount to one to two hectares for each structure. In deeper waters (over 91 meters), a semisubmersible drilling rig with its anchoring system would occupy up to 66 hectares (assuming a 457 meter anchoring radius). Trawling depths range from approximately 9 to 791 meters; therefore, structures beyond the 91 meter depth would have a minimal impact on trawling operations. The duration of exploratory drilling ranges from approximately 45 days for a single well to around six months for multiple well explorations. Permanent production platforms may remain in place for 10 to over 20 years.

The probability that permanent platforms will be erected on any leased tract, based on past exploration success rates, is about 32% for offshore Louisiana.

Approximately one out of three tracts will require a platform (or platforms). It is estimated that each full tract (2,331 or 2,023 hectares) developed will average two platforms. Using the actual dimensions of a platform, two per tract would physically cover approximately 0.02% (0.4 hectares) of each tract's sea floor. Taking into account a navigational safety zone around each structure and using the one to two hectares per platform figures, trawlers may be denied up to 0.2% (four hectares) of the sea floor per developed tract assuming two platforms are erected. The number of new platforms expected from this sale ranges between 20-40 therefore, the maximum area denied fishermen would be 160 hectares for the duration the platforms are in place. Location and water depth of these platforms is unknown (i.e., placement on shrimp grounds); however, stipulation c (Mitigating Measures Included in the Proposed Action) concerning the limiting of structures will be considered when planning the placement of structures. In this manner, fishing interests at any particular proposed development site can be considered in detail on a case-by-case basis. In addition, offshore rigs and platforms present navigational problems to fishermen. Boats engaged in trawling will be inconvenienced by having to navigate around fixed structures and there exists the possibility of fishing boats colliding with structures.

A Coast Guard summary for the period July 1, 1962 through June 30, 1973 reported ten collisions of fishing boats with offshore structures. Causes of these collisions were personal neglect aboard fishing boat (5), equipment failure on boat (1), equipment failure on rig (3) and insufficient and improper light of rig (1). There was only one injury, total damage to boats amounted to $151,000 and damage to platforms $24,000.

It is obvious that commercial trawling may be adversely affected to some degree for the next few years because of reduction in trawlable grounds; however, the extent of this is not known but will be more cumulative in nature. There are no data to indicate that offshore exploration is responsible for any decline in catches at present. There is reason to expect that with an increase in the number of platforms, the chance for increased fishing boat collisions with these platforms will result; however, this is unquantifiable.

### UNDERWATER OBSTRUCTIONS

Underwater obstructions or completions have little ecological importance but may cause problems to trawlers. The obstructions referred to here are, submerged well heads, underwater stubs, and large pieces of debris which when snagged, may cause damage to trawls and nets.

The source and nature of underwater stubs is described in Appendix D-3 of FES No. 41 (USDI, 1975b, Vol. 2). As previously stated, Coast Guard regulations require that stubs be marked by a lighted buoy at the surface if there is less than 26 meters of clearance. Stubs with clearance of between 26 and 61 meters must be buoyed; however, a lighted buoy is not required. These buoys are frequently missing despite regular maintenance and replacement. Also, if in water depths of 26 to 61 meters, the stub is covered by a bonnet, then it need not be marked by a buoy.

Another safeguard has been the plotting of these stubs on navigation charts for vessels with accurate navigational equipment.

In addition Loran-A (navigation instrument most used by fishermen) readings have been recorded and published in numerous publications. Fishermen use these readings to avoid areas where stubs or obstructions may be located.

Large pieces of debris, such as equipment, piping, structural members, tools and the like, may accidentally be lost off a platform, service boat or barge. If this occurs near a platform it may be located by divers and retrieved as specified in OCS Order No. 8. However, if it is lost from a boat or barge underway, the location may not be known accurately enough to allow its subsequent recovery.

The number of underwater obstructions is unknown; however, stipulation c (Mitigation Measures Included in the Proposed Action Section) concerning the limiting of structures is considered when planning the placement of structures. In this manner, fishing interests at any particular proposed development site can be considered in detail on a case-by-case basis.

### OIL POLLUTION (CHRONIC AND ACCIDENTAL)

St. Amant (1974) stated that chronic pollution from offshore production sites represents an unknown factor. Daily drips and loss of small amounts of oil or other chemicals overboard do not appear to generate ecological problems because of the immense water volumes compared to the small amount of oil lost. Whether such sublethal pollution levels will eventually accumulate and cause environmental degradation has not been determined.

Dr. J. T. Thompson, investigating for the Gulf Universities Research Consortium (1974), found no evidence to indicate either harmful or beneficial effects of the placement and maintenance of offshore oil platforms on the bottom fisheries on the open shelf. His study included the most abundant bottomfish trawl fauna of the north central Gulf of Mexico, between longitudes of 89°30′ N. and 92°30′ W., and 18–137 meters across the Continental Shelf off Louisiana. Dr. Thompson used data from the work of the Bureau of Commercial Fisheries (now National Marine Fisheries Service), with the M/V Oregon and other chartered vessels from 1950-65. This period saw the rise of the offshore oil industry in the study area. Dr. Thompson also stated that no trends were apparent through the period in either quantity or distribution of species studied.

Dominant fishes for the study included croaker, spot, scup, cutlass fish, sea catfish, sea trout, ground mullet and lizard fish. Dominant invertebrates included offshore blue crabs and the brown and rock shrimps.

In an area of a chronic oil spill, commercial fishing activities are inhibited in order to avoid contamination of fishing equipment, vessels and catch. Also long term deleterious effects could result. There are three particularly important ones, impossible to quantify: (1) If large amounts of plankton were destroyed the food web could be seriously disrupted and result in population crashes of organisms directly or indirectly dependent upon the plankton. (2) Entire year classes of juvenile or larval fish might be destroyed resulting in greatly reduced yields several years after the spill. Ketchum (1973) refers to Mironov's work in 1967, stating there was 100% mortality in developing flounder spawn at concentration, ranging from 1-100 ppm in three types of oils. (3) Oil pollution might lower organisms' resistance to disease and other environmental stresses. This could produce less robust, lighter weight individuals and an increased mortality rate over a long period of time, causing a slow, but marked decline in fisheries. Ketchum (1973) showed that abnormal development occurs following longer periods of exposure to concentrations as low as 0.01 ppm. (4) Fish may have to be discarded due to tainting of the flesh. One example was given by Connel (1971) who stated that the Australian mullet had a kerosene-like tainting due to the presence of kerosene-like hydrocarbons in the flesh. He found the contaminated compounds to be similar to substances isolated from river sediments. The river used by the mullet flows alongside oil refineries and associated storage and wharf facilities. Volatile hydrocarbons were found in the water adjacent to petroleum storage facilities and also in the river's estuary near a sewage fallout. Seatrout and plaice were also found to be tainted according to taste test. These fish were caught after the Torrey Canyon incident involving the spillage of Kuwait crude oil. No chemical analysis by chemical class was reported (Clark, 1973).

Numerous studies on the effect of oil on commercially important shellfish indicate that these invertebrates may both absorb, and to varying extents, clean themselves of hydrocarbons.

Oysters (*Crassostrea virginica*) may accumulate oil through feeding activity in a pollution zone. As the oyster feeds, it pumps water over a series of gill filaments which trap food particles such as phytoplankton. Hydrocarbons in the plankton may be incorporated in the oyster. Ehrhardt (1972) reported that oysters taken near the entrance to the Houston Ship Channel in Galveston Bay, Texas are contaminated with a high content of petroleum derived hydrocarbons. Because aromatic hydrocarbons are more soluble than paraffinic and naphenic hydrocarbons, the oysters most likely take up the aromatic fraction as a water solution through their gills, and as filter feeders by accumulation of particulate food matter. The author found the composition of oyster contaminants to be similar to many Texas crude oils, among them Conroe, Beaver Lodge and Lee Harrison crude.

Results from Blumer's (1971) study on more highly aromatic No. 2 fuel oil rather than on crude oil suggest that oil becomes part of the organism's lipid (fatty) pool. Blumer noted that the oil in specimens observed from a Massachusetts oil spill remained relatively, unchanged in composition or quantity. He reasoned that if the oil were localized within the digestive tract, a shellfish could eliminate it rapidly. But the persistence of the hydrocarbon over a period of six months, its presence in adductor muscle tissue and the lack of further degradation of these hydrocarbons indicated that it becomes part of the organism's lipid pool.

Anderson (1973) observed oysters (*Crassostrea virginica*) and clams (*Rangia cuneata*), exposed to southern Louisiana crude oil and No. 2 fuel oil, and came to a different conclusion. Anderson found that both aromatic and saturated hydrocarbons are released from the tissues more rapidly; maintenance in clean water for periods of 24 to 52 days was reported sufficient to cleanse the tissues of detectable levels of hydrocarbons.

Teal and Stegeman (1973) measured the amount of hydrocarbons remaining in contaminated oysters after their return to clean water and found that a concentration of 34 mg/g wet wt. persisted in a "stable" compartment. The authors concluded that, while the oysters would not retain non-biogenic (petroleum) hydrocarbons permanently complete removal would take a "considerable amount of time".

St. Amant (1973) reported that under field conditions, oily tastes generally occur in oysters when the substrate exceeds 500 ppm of hydrocarbon. He said "that if the oysters are removed to unpolluted areas and allowed several months of depuration they will eventually purge themselves of oil to a point where noxious tastes are not detectable". This of course, does not assure the absence of all petroleum hydrocarbons.

Scarratt (1971) has found that commercial species of scallops ingested spilled Bunker C oil. Subsequent chemical analysis revealed the presence of Bunker C in the mantle, digestive gland, adductor mussel and gonad.

However, Heitz, et al. (1974) found that the lethal level for shrimp, *Penaeus* sp., was 35 ppm (Sept.-Dec.) and 15 ppm (Jan.-Mar.), when he studied the effects of hydrocarbons on enzyme activity of shrimp. He noted that oil does not kill immediately by poisoning enzyme systems. There are both subtle cellular effects and immediate physical effects (the latter in the gills). St. Amant (1973) referred to a concentration of oil of 10 ppt as being lethal to these shrimp. He added, however, that to reach this concentration under field conditions, more than 3,000 gallons of oil per acre-foot of water would be required to meet the concentration. This concentration is rarely acquired except in the immediate area of a spill.

In summary, oil spills could have both short and long term impacts on commercial fisheries; however, no measurable effects have been observed for chronic or accidental spills of oil. Oil spills may physically prevent fishing in contaminated areas. Adult finfish are not normally killed outright, but possibly could suffer a long term decline due to lowered resistance to disease and environmental stress. Larval and juvenile fish could be killed in great numbers if a spill reached spawning or nursery grounds (i.e., estuary). Many fish not destroyed may be tainted with hydrocarbons and be unmarketable. Shellfish are more susceptible to contamination because of their inability to escape and their general filter feeding habits. Many larval and juvenile could be killed outright. Survivors could be tainted and unmarketable for long periods. Authors disagree on the time required for shellfish to cleanse themselves. Estimates vary from several months for complete depuration to six months with no depuration.

Additional discussion on the impact of oil on fisheries may be found in Impact on the Living Components of the Environment. These sub-sections also contain discussions on the impact of drill mud and cuttings associated with drilling operations.

### PIPELINES

BLM is presently conducting a thorough search for data pertinent to a better understanding of the problems of anchor and fishing gear hangups on pipelines. Reliable data relevant to this problem are needed to help determine what burial depths are sufficient to prevent damage. BLM through its permit authority, requires pipelines to be buried a minimum of one meter out to a water depth of 61 m (200′). Beyond this depth, pipelines are not required to be buried or marked by lighted buoys. USGS permitted pipelines require that all pipelines be compatible with trawling operations, a spokesman for the offshore pipeline industry indicated, through their experience in the installation and attempted maintenance of lighted and unlighted buoys, that a marker system in deeper water is extremely difficult to maintain. Heavy seas damage the buoys and their gear, and if sufficient slack is allowed to combat heavy wave action, then the buoy will not closely indicate the location of the pipeline. Compounding the problems is the history of alleged pilferage and vandalism which shortens the useful life of these markers. In any event, the data necessary for a determination as to the scope and significance of potential damage to fishing gear resulting from unburied and unmarked pipelines beyond 81 meters in depth has not been forthcoming from either the fishing industry or any government source. Snow (1974) in outling the pipeline policy of the Louisiana Shrimp Association states, “It is our opinion and recommendation, that within the 81 meter contour, all pipelines should be buried”.

Furthermore, because of the small amount of pipeline planned for this proposed sale, and the slight risk of a snag presented by a pipeline, the costs involved in burial or marking of pipelines beyond 81 meters far outweigh the benefits. In addition, valves and taps are buried beyond 81 meters. Presently under development by National Ocean Survey and BLM is a program to chart all major offshore pipelines and flow lines. Several charts for regions of the Gulf of Mexico have how been issued. Hopefully, fishermen in the Gulf will find these charts useful.

Before BLM issues the permit for the right-of-way for any common carrier pipelines, Environmental Analysis Record (EAR) is prepared to determine whether the action warrants the preparation of an Environmental Impact Statement. The EAR along with the application from the pipeline operator is used in the decision making process as to the possible adverse impacts that the action might have on the OCS. Although BLM has no authority inside the three-mile limit of jurisdiction, if a proposed pipeline requires a beach or marsh crossing, anticipated impacts upon the ecosystem are fully discussed in the EAR. In order to reduce the impact upon the beaches and marshes pipeline corridors must be considered as an alternate to random landfalls. In the event that affected States initiate pipeline corridor plans, BLM will participate in very possible way.

Kilegen and Harris (1973) studies the mariculture potential in estuarine oil-pipeline canals and reported that many of the closed-off canals in estuarine areas can be managed to produce annual crops of fishes and shellfishes of commercial and recreational value. Some canals have yielded high standing crops of several fish species and crabs. One of the most promising management techniques is that of using cage culture for a commerical fish species, such as channel catfish or pompano. This method of fish culture eliminates problems of predation, flooding of canals and harvesting. Sport fishes, such as speckled trout, red drum and others, with forage species, could be stocked and managed in the same canals. Another alternative would be to stock shrimp or oysters in canals, with fish raised in cages. The shrimp would eat waste material from under the cages, and oysters, grown on racks, would filter out algae and other foods from the canal waters. This system would provide maximum benefits from a relatively unused resource, increasing its commercial value by several hundred dollars per hectare. For these reasons, it is imperative that research be continued towards development of canal fisheries management techniques, so that these valuable resources will not be lost.

A caution should be mentioned, however, in citing the advantages to mariculture of using pipeline canal routes. The construction of such canals along estuaries includes much heavy dredging and earth moving. If great care is not taken, adverse sedimentation and turbidity increases in the estuary will follow. Such sedimentation and turbidity can bury benthic organisms and decrease productivity by eliminating sunlight in various water depths.

### REEFS (MAN-MADE AND NATURAL)

Man-made reefs (in this instance) refer to those reefs created by the placement of platforms. These platforms serve as a haven and shelter for many types of fishes and invertebrates, mainly fouling organisms, GURC (1974) investigation reported these findings concerning the biomass associated with these structures: The platforms are sites of marked increase in biomass due to the ''reef effect'', over one to two orders of magnitude higher than other biotopes (Table B-1). Components of this increase are the fouling community and the fishes they attract which are responsible for this portion of the economically important sports and commercial fishery. A discussion on fishing banks may be found in Impact on Biologically Sensitive Areas.

Table B-1 Biomass Determination

| | Timbalier Bay | Platform 54A | Offshore Control |
|---|---|---|---|
| Organic Carbon in water | 8.3-14.5 gm/$m^3$ | 5.8 gms/$m^3$ | 5.1 gm/$m^3$ |
| Hydrocarbons in water 1/ | 6.2 mg/$m^3$ | 3.3 mg/$m^3$ | 1.2 mg/$m^3$ |
| Hydrocarbons in surface film | not studied | 0.21-1.27 mg/100 grams | 0.12-1.27 mg/100 grams |
| Hydrocarbons in sediments | 161-341 mg/100 grams | 145-412 mg/100 grams | 145-412 mg/100 grams |
| Primary Productivity | not studied | 1.07 gms/ m 2//day | 1.03 gms/ m 2//day |
| Amphipods | 8.75 gm/m 2/ | 24.2 gm/m 2/ | 17.7 gm/m 2/ |
| Zooplankton | 0.02-0.2 gm/$m^3$ | 0.3 gm/$m^3$ | 0.3 gm/$m^3$ |
| Polychaetes | 0.3-5.0 gm/m 2/ | not studied | N.A. |
| Platform growth | N.A. 3/ | 3000 gms/m 2/ pile surface | N.A. |

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1/ Hydrocarbons from all sources, including petroleum, organic detritus, plankton, etc.

2/ Substantially higher offshore Louisiana than other regions investigated in the open Gulf and offshore Florida.

3/ N.A. - Not Applicable.

## Impact on Air Quality

The quality of air over the proposed sale area could be degraded by several types of sources including exhaust emissions of stationary power units, service vessels and by the accidental release of oil and gas from wild wells.

An average composition (Levorsen, 1967) of natural gas from an onshore field (an offshore field would be similar) in Texas is as follows: methane 92.5%, ethane 4.7%, propane 1.3%, butane 0.8%, and pentane and heavier gases, 0.6% (small amounts of sulfur are usually present).

If a blowout should occur at a gas well and did not burn, the above gases in a comparable ratio would be released into the air. A typical Texas offshore well produces approximately one million cubic feet of gas per day. A blowout could reasonably be expected to release at least this much gas into the atmosphere. However, if the gas well were burning, combustion would be essentially complete and the emissions would consist almost entirely of carbon dioxide ($CO_2$), water, and any sulfurous gases would be oxidized to $SO_2$. It is impossible to predict the probability of this occurrence. Since essentially all of the components of natural gas are non-reactive, there would be little impact whether or not they are burned. Therefore, recovery of this resource for use as a fossil fuel could result in a positive impact in some areas by providing energy by the cleanest source to be utilized, thus helping to alleviate air pollution.

If a blowout at an oil well occurred and released crude oil into the water, the resulting impact would be substantially greater, as discussed in Impacts on the Living Components of the Environment. If the oil does not burn, a significant amount of it would evaporate. During the Chevron 1970 spill, it was estimated that approximately 15% of the 30,000 barrels (bbls.) spilled evaporated. At an average density of 310 lb/bbls, this incident would have introduced approximately 1.4 million lbs of hydrocarbons into the air. Some oil spills in the past have resulted in fires, however, the chance of this occurring is minimal. In fact, if this were to occur, emissions from the crude oil would be relatively low in reactive compounds.

A reasonable estimate of the range of emission, assuming complete combustion, that an oil well fire could produce per 1,000 bbls burned, might be as follows (Levorsen, 1958): $CO_2$: 340,000-347,000 lbs., $SO_2$: 620-34,000 lbs. ($SO_2$ emission would be less for Gulf of Mexico crude oil, which range from 0.1 to 0.5% sulfur), and NO: 660-10,000 lbs.

Combustion of oil would be incomplete; however emissions would contain a smaller amount of the above compounds, and would include such materials as volatilized petroleum, particulate carbon, carbon monoxide, nitrous oxide, sulphur monoxide, along with other altered or partially oxidized matter. There is no reliable way to predict in advance the relative volumes of each of these possible emissions because it would depend, among other things, upon moisture content of the air, wind speed, pattern of oil spray from wild wells, number of wells involved, chemical content and physical character of the oil itself, and types of equipment and materials other than oil that might also burn.

Massive spills from wild wells are not the only source of spilled oil. A number of minor spills during the first nine months of 1972 released over 800 barrels of oil. The net result is that a small amount of spilled oil is floating somewhere on the waters of the Gulf of Mexico almost continually. The evaporation of this oil may cause elevated levels of hydrocarbons in the sea breeze coming off the Gulf. At the present time there is no evidence as to the source of these materials.

An increase in refinery capacity will add to the total emissions of oxides of nitrogen, sulphur dioxide, hydrocarbons, carbon monoxide, hydrogen sulfide and particulates affecting air quality onshore. An increase of up to 30,000 barrels per day in refinery capacity and other petrochemical industries which process the predicted production resulting from this proposed sale would cause a small increase in emissions. However, oil produced as a result of this proposed sale may not necessarily create the need for increased refinery capacity and other petrochemical industries. Instead, it may take the place of oil that will not be furnished from domestic sources due to declining production or other factors. In summary, it cannot be accurately predicted the degree to which air quality will be deteriorated from refinery use as a result of production from this proposed sale.

## Impact on Water Quality

During drilling and oil production the water quality of the Gulf may be altered and degraded in several ways. Many of the chemical and physical factors which will be transferred to the Gulf during various phases of oil production will represent potential hazards to water quality. These potential hazards of degraded water quality may be found to be insignificant or significantly adverse. The magnitude of these potential hazards should be answered by future research.

On September 15, 1975, the EPA published in the Federal Register (40 CFR 435) a notice of interim final effluent limitations guidelines and new performance standards for the offshore segment of oil and gas extraction point source category. These effluent limitations guidelines are concentration based as opposed to a mass per unit production base. It is indicated that the major source of waste waters generated by offshore facilities are produced waters. The major constituents formations in the waste waters resulting from the oil and gas extraction industry are oil and grease, residual chlorine, and floating solids.

Several methods of treatment technology for waste water from produced waters may be employed to achieve final limitations. It is also noted that drilling muds and drill cuttings may be discharged if they are water based and their discharge does not result in free oil on the surface waters. Muds and cuttings that are oil based may not be discharged, and by 1983 new source performance standards will require no discharge of waste water pollutants into navigable waters for those wastes generated by produced water sources of this subcategory. However, the no discharge requirement for produced waters presently applys only to State waters.

Limitations have established the quantity and quality of pollutants or pollutant properties which may be discharged by a point source subject to the provisions of the EPA (1975) (Tables D-1 and D-2).

Sewage will be treated in accordance with OCS Order No. 8, which requires that the treated effluent contain a minimum of 1.0 ppm residual chlorine after a retention time of 15 minutes. Treated sewage of this type which has proper discharge diffusion should produce a minimum amount of water quality deterioration.

To some degree, bottom sediments would be put into suspension by the emplacement of reentry collars, blowout preventors, drilling platforms and other sea-bottom equipment. The magnitude and extent of resultant turbidity would be dependent on the type and grain size of bottom materials, the prevailing water current and the duration of the activity. Proposed lease areas should have a short term impact from resultant temporarily increased turbidity.

Water quality degradation is also effected by resuspension of sediment during pipeline construction and burial. The jetting away of the substrate from beneath the pipeline will result in suspension of sediment which may be rich in pollutants. The sediment plume will move away from operations in the direction of the current. The plume can reach proportions of several yards wide and hundreds of yards long if the substrate is exceptionally muddy. The duration depends on the particulate size, shape, and density of the material suspended and the water's turbulence. After construction, normal pipeline operations will have no effect on the water quality. Adverse long-term impacts can result when pollutants are resuspended in the water column.

During drilling operations, drill cuttings may be discharged into the Gulf. Most cuttings will consist of sandstone and shale fragments; however, some silt and sand size cuttings may be produced and discharged into the water. We estimate that 1,700 barrels of cuttings may be discharged during the course of drilling an average 10,000 foot well over a period of 10 to 14 days.

Drill cuttings discharged into the Gulf that could contain drilling mud if not properly washed, would be dispersed and fall to the Gulf floor. The accumulation density on the Gulf floor and the degree of turbidity resulting from drill cuttings will depend on the current and the water depth in the area of discharge. The increase in turbidity will present a short-term decrease in the water quality. This impact will be of low magnitude.

Drilling muds that are used during drilling operations will be discharged periodically or accidentally into the Gulf. Several studies have been carried out in repect to the effects of drilling muds and cutting discharges on the marine environment. Toxicity studies showing that heavy concentrations of barium sulfate exhibit no toxicity to fish were performed by Grantham and Sloan, 1975. However, preliminary research

## Table D-1 Offshore Segment - Oil and Gas Extraction Industry

## Effluent Limitations - BPCTCA 1/

| Subcategory | Water Source | Oil & Greese - mg/l | | Residual Chlorine mg/l |
|---|---|---|---|---|
| | | Maximum for any one day | Average of daily values for thirty consecutive days shall not exceed | |
| A. Near Offshore (State Waters) | produced water | 72 | 48 | N/A |
| | deck drainage | 72 | 48 | N/A |
| | drilling muds | 2/ | 2/ | N/A |
| | drill cuttings | 2/ | 2/ | N/A |
| | well treatment | 2/ | 2/ | N/A |
| | sanitary M10 3/ | N/A | N/A | greater than 1 4/ |
| | M91M 3/ | N/A | N/A | N/A |
| | domestic | N/A | N/A | N/A |
| | produced sand | 2/ | 2/ | N/A |
| B. Far Offshore (Federal Waters) | produced water | 72 | 48 | N/A |
| | deck drainage | 72 | 48 | N/A |
| | drilling muds | 2/ | 2/ | N/A |
| | drill cuttings | 2/ | 2/ | N/A |
| | well treatment | 2/ | 2/ | N/A |
| | sanitary M10 3/ | N/A | N/A | greater than 1 4/ |
| | M91M 3/ | N/A | N/A | N/A |
| | domestic | N/A | N/A | N/A |
| | produced sand | 2/ | 2/ | N/A |

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1/ BPCTCA, best practical control technology currently available.
2/ No discharge of free oil to the surface waters.
3/ There shall be no floating solids as a result of the discharge of these materials.
4/ Minimum of 1 mg/l and maintained as close to this concentration as possible.

## Table D-2 Offshore Segment - Oil and Gas Extraction Industry

### Effluent Limitations - BATEA and New Source 1/

| Subcategory | Water Source | Pollutant Parameter - Effluent Limitations | | |
|---|---|---|---|---|
| | | Oil & Grease - mg/l | | Residual Chlorine - mg/l |
| | | Maximum for any one day | Average of daily values for thirty consecutive days shall not exceed | |
| A. Near Offshore (State Waters) | produced water | No Discharge | | |
| | deck drainage | 72 | 48 | N/A |
| | drilling muds | 2/ | 2/ | N/A |
| | drill cuttings | 2/ | 2/ | N/A |
| | well treatment | 2/ | 2/ | N/A |
| | sanitary M10 | N/A | N/A | greater than 1 3/ |
| | M91M 4/ | N/A | N/A | N/A |
| | domestic 4/ | N/A | N/A | N/A |
| | produced sand | 2/ | 2/ | N/A |
| B. Far Offshore (Federal Waters) | produced water | 52 | 30 | N/A |
| | deck drainage | 52 | 30 | N/A |
| | drilling muds | 2/ | 2/ | N/A |
| | drill cuttings | 2/ | 2/ | N/A |
| | well treatment | 2/ | 2/ | N/A |
| | sanitary M10 | N/A | N/A | greater than 1 3/ |
| | M91M 4/ | N/A | N/A | N/A |
| | domestic 4/ | N/A | N/A | N/A |
| | produced sand | 2/ | 2/ | N/A |

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1/ BATEA, best available technology economically achievable, not later than July 1, 1983.
2/ No discharge of free oil to the surface waters.
3/ Minimum of 1 mg/l and maintained as close to this concentration as possible
4/ There shall be no floating solids as a result of the discharge of these materials.

results at EPA's Environmental Research Lab in Gulf Breeze, Florida have indicated that pentachlorophenol, a biocide used in drilling fluids, is toxic to salt-water fishes and may affect the structure and diversity of biota in marine and estuarine communities. Studies have been carried out in regards ferrochrome lignosulfonate by Zitko, 1975 and McAtee and Smith, 1969. Hollingsworth and Lockhart, 1975 have carried out toxicity studies on ferrochrome ignosulfonate and have found it to be of low toxicity. Water base muds, cuttings and other waste fluids can be considered pollutants when waste treatment is not utilized. Possible pollutant characteristics include: Acute toxicity to fish; high immediate dissolved oxygen demand; and high concentrations of organic carbon, total nitrogen, phosphorus, solids, chemical oxygen demand and chromium.

The production and discharge of formation waters (oil field brines) has been discussed earlier. Three components or properties of formation waters contribute to water quality degradation when released into the Gulf. These include: entrained liquid hydrocarbons, dissolved minerals salts, and absence of dissolved oxygen.

Depending upon the formation from which an oil field is producing, dissolved elements and their respective concentrations in formation water may differ. However, the components of each reservoir will usually remain constant unless leakage occurs from one reservoir to another.

Wells that are in an initial stage of production may have formation waters which represent 20-30% of the total extractable fluid. As the oil reservoir is depleted, the amount of formation water increases. The maximum amount of formation water produced during the life of oil production will be approximately 0.6 barrels of formation water per barrel of oil produced.

To determine water production, the peak oil production is multiplied by the maximum water to oil ratio. The maximum water to oil ratio does not occur during periods of peak production. The water to oil ratio should be less than one during peak production and near one toward the end of the primary production period.

Within the proposed lease area, the maximum oil production is estimated to be 100-200 million barrels of oil. This would be extracted over a twenty year period. The expected annual production of oil will be from 2.7-10.7 million barrels. Considering the maximum amount of formation water production (0.6 barrels of formation water per barrel of oil produced), approximately 1.6-6.4 million barrels of formation water per year will be produced providing that all the tracts are leased and developed.

In the Gulf of Mexico many platforms are disposing of treated formation waters where the treatment equipment puts out an effluent less than 25 ppm oil content, but many older platforms are not accomplishing this. Other locations only manage to meet the requirements of OCS Order No. 8, by releasing waters with entrained oil averaging less than 50 ppm. The range of oil concentrations discharged from surveyed production platforms in the Gulf ranged from 6-827 ppm (EPA, 1974).

Due to many factors which will contribute to the physical and chemical characteristics of formation waters, no estimate can be made to the extent of the impact from these waters. The characteristics of formation water can change during the oil production period as more reservoirs are tapped or leakage occurs between reservoirs. Formation waters may contain significant concentrations of toxic materials; i.e., cyanide, cadmium, chromium, lead and mercury (EPA, 1974). Therefore, it is concluded that formation waters represent a potential significant hazard which could degrade the water quality and which may have adverse effects on the marine biota. Injection of formation waters into depleted, producing or an unrelated formation could eliminate this effect on water quality. Table D-3 indicates the content of three representative brines (formation water) from offshore Louisiana. They are classed as formation waters containing high, average, and low solids.

Water quality could be further degraded as the result of accidental oil spills. Part of this spilled oil would be removed by clean-up operations and some would probably be dispersed into the waters of the Gulf where it will be reduced further by microbial degradation and weathering.

It is estimated (USGS, 1975) that from zero to two terminal storage facilities may be constructed onshore as a result of this proposed sale. This proposed construction may have a slight impact on the water quality in the vicinity of these facilities.

## Impact on Ship Traffic and Navigation

In the Gulf of Mexico safety fairways have been established for the safe passage of vessels enroute to or from U.S. ports. Consequently, placement of rigs or platforms are prohibited within these fairways. Ships do not always use these fairways and this increases the possibility of a collision with drilling rigs, permanent platforms or vessels attending these platforms. Impacts which could result include loss of human life, spillage of oil, release of debris, including part of or the entire drilling rig and the ship. The contents of the ship's cargo could pose a serious threat to the environment if it includes toxic materials such as chemicals, crude oil or refinery products.

A marine casualty is any casualty involving a vessel other than a public vessel, if such casualty occurs upon the navigable waters of the United States, its territories or possessions, or any casualty involving a United States vessel, wherever the casualty may occur. Casualties involving commercial vessels must be reported to the U.S. Coast Guard whenever the casualty results in any of the following: actual physical damage to property in excess of $1,500; material damage affecting the seaworthiness or efficiency of a vessel; stranding or grounding; loss of life; or injury causing any person to remain incapacitated for a period in excess of 72 hours, except injury to harbor workers not resulting in death, and not resulting from vessel casualty or vessel equipment casualty.

Eight cases involving collision of vessels of over 1,000 gross tons with fixed structures were reported in the Gulf of Mexico during the period from July 1, 1962, through June 30, 1973. Twenty-two other collisions of vessels less than 1,000 gross tons with fixed structures were reported during this eleven year period. Fifteen of the accidents involved vessels less than 100 gross tons and the remaining seven vessels ranged between 100 and 650 gross tons. Of the twenty-two accidents, there was no loss of life involved and damage to the rig was insignificant (USGS, 1974).

For the period from July 1, 1973 to June 30, 1975, there were 32 collisions of vessels with fixed structures reported. Three collisions involved vessels of over 1,000 gross tons. Thirteen collisions involved vessels from 100 to 1,000 gross tons. Sixteen collisions involved vessels of less than 100 gross tons (USCG, 1976).

Figure E-1 shows the increase in the number of offshore structures versus the small number of accidents during the period 1965 through 1973 involving these platforms in the Gulf of Mexico. It should be noted that while the number of structures is increasing, the number of accidents involving structures has not increased. The accidents involving small vessels might in some cases be considered self-generating; that is, the fishing vessels could have been near the rigs due to the improved fishing around the structures, and the barges, cargo and passenger vessels could in some cases have been servicing the platforms.

The most serious environmental hazard involving offshore structures and shipping accidents would occur in the case of an oil tanker colliding with a platform. In this theoretical case, supertankers might be considered in a more favorable light than small tankers if the following were the case: The offshore terminal buoy process was used. They are known as offshore deepwater terminals or ''Superports''. The fairway, the area near the fairway and the area around the terminal buoy had no nearby bathymetric hazards, or these hazards were carefully surveyed and marked. The super-tankers were kept in the fairways in the area of offshore structures. The super-tanker traffic was restricted to one way traffic in the fairways so that tankers were never on head-on courses.

In summary, the possibility exists for an increased number of collisions to occur as the number of platforms increase.

OFFSHORE STRUCTURES AND SHIPPING ACCIDENTS INVOLVING RIGS OR PLATFORMS.

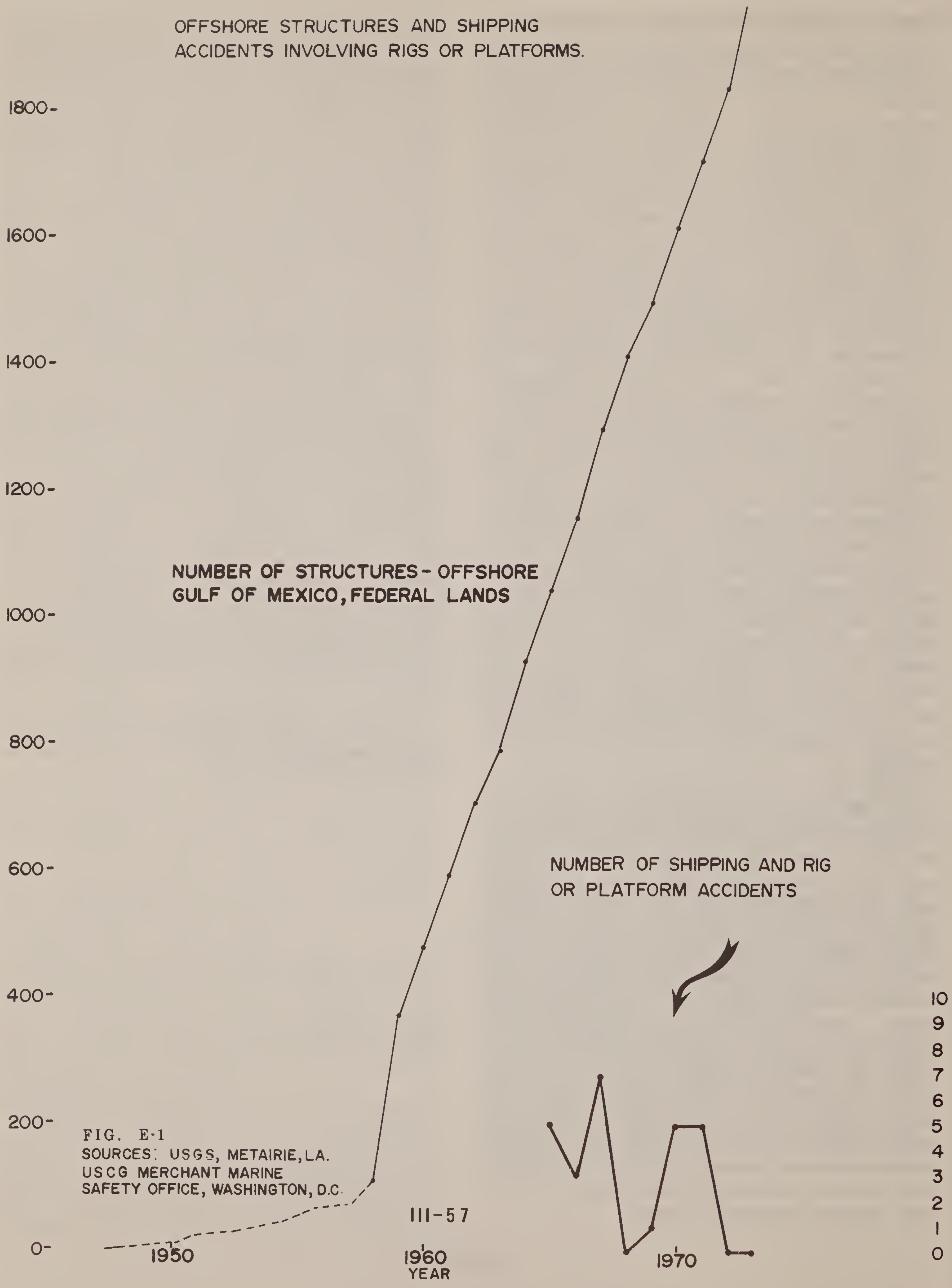

FIG. E-1
SOURCES: USGS, METAIRIE, LA.
USCG MERCHANT MARINE
SAFETY OFFICE, WASHINGTON, D.C.

## Impact on Military Uses of the Continental Shelf

The Gulf of Mexico is used rather extensively by the Navy and Air Force for conducting military training and research operations. These current activities consist of missile testing, ordnance testing, drone recovery operations, electronic counter measure (ECM) activities by the Air Force and training of military personnel. Mine research activities are conducted by the Department of the Navy. Most of this activity takes place in areas designated for these purposes. Live ordnance testing by the Air Force occasionally involves emergency release of ordnance outside designated bombing areas; however, these are limited to practice bombs containing 10-pound explosive. Because Air Force procedures provide for dropping ordnance over water in the event of an emergency, which precludes the use of a designated salvo area, a potential hazard exists. Such emergencies have occurred in the past, and ordnances have been jettisoned as far shoreward as Choctawhatchee Bay. No quantification as to the amount of ordnance located in and outside the salvo areas was available. The possibility of occurrence of unexploded munitions on the ocean floor in the proposed lease sale is extremely remote.

Oil and gas operations in an ordnance disposal area are potentially hazardous. The accidental detonation of munitions during the course of oil and gas drilling or other activities, should it occur, could result in loss of life, destruction of property or creation of a potential for fire and polluting events and death or injury by concussion to marine life. At this time, we consider the probability of occurrence low because unexploded ordnances and sunken WW II vessels are detectable through magnetometer surveys and sophisticated magnetic detection devices. Also, in many cases, divers can be used to aid in locating and plotting munitions and sunken vessels on the ocean floor.

The possible use of shallow, nearshore portions of the continental shelf for ordnance disposal would prohibit full exercise of the multiple use concept common to natural resource management programs. However, it is not Department of Defense (DOD) policy to dispose of ordnance in shallow waters. Such disposal is only carried out in an extreme emergency and only when necessary for the preservation of life or saving of an aircraft and never as a routine disposal procedure. Therefore, this conflict is not anticipated should this proposed sale proceed.

## Impact on Beach and Shoreline Recreation

Recreational activity on beaches and in shoreline areas can receive impacts from pipeline construction onshore, from oil spills and from the placement of onshore facilities (such as production terminals or transfer facilities) should they be located in or near a recreational area. Additional minor impacts from debris washup could result from exploration and well support activities.

No pipelines are projected to be brought ashore as a result of this sale unless production results in an area remote from existing transportation facilities. If a pipeline crosses a beach area used for recreation, there will be an impact. The area of beach disturbed by construction would be fairly small (9 meters wide) and high tides following burial of the pipeline would soon serve to restore the beach terrain. Restoration of the beach would take longer, most likely requiring a storm tide or high winds to obliterate the effects of excavation. Should a pipeline enter a marsh shore there would be little beach activity affected; however, there could be long lasting visual impacts due to vegetative and drainage disturbance in the laying process. Likewise, a pipeline crossing a shore backed by forest vegetation will produce an obvious corridor which may be noticeable for many years. Physical interference with recreational activities, should a pipeline be needed, will be minimal and short-lived.

If production terminal facilities are located in or near a beach or any other area used for recreation, there will be an adverse impact from disruption during the construction phase and elimination of about 16 hectares per terminal plant for recreational uses. This latter impact would be long-term and restoration of the area, if attempted at all, would have to await the depletion of the offshore production which the plant would be designed to serve. These impacts may tend to diminish quality of the area for recreational enjoyment.

Water sports such as swimming, diving, spearfishing, underwater photography, fishing for finfish and shell fish, boating and water skiing would also be directly affected by an oil spill. These would also be affected where chronic low-level discharges have caused a degradation of the environment.

Other marine related activities such as beachcombing, shell collecting, painting, shoreline nature study, camping and sunbathing on a beach would be made much less attractive for an indeterminate period if an oil spill were to come onshore.

Removal of oil from beaches used for recreation in the area under consideration would probably involve removal of the contaminated sand and possibly replacement of the sand, if needed. The time period of clean-up in this case would depend on the extent of beach area affected. Recreational use of the area would be precluded during the time that oil covered the beach and also during the clean-up process.

The impacts of an oil spill discussed above would be more keenly felt if the recreational area involved is intensively used or considered to have unique or outstanding recreational values, such as Grand Isle State Park, Galveston and Padre Islands. Not only would the impact be felt by the recreational users of the area, but, consequently, the community of businesses whose economic well-being depends on use of their recreational resources by tourists. If an oil spill were to cover outstanding recreational beaches during the heights of the recreational season, the impact could be expected to be more severe, in that residents and tourists would not be attracted to a beach area contaminated by oil or undergoing a cleanup process, and there would be a resultant economic loss.

As a result of this proposed sale, approximately 161 kilometers of new pipeline may be needed and possibly two new onshore terminals. Location of facilities would, of course, depend upon which tracts are leased and where new production actually occurs. It is unlikely that any new pipeline land-falls or shore facilities would be needed in the central Gulf area.

Most of the tracts to be leased lie south of Louisiana, some as close to shore as five kilometers and some as far out as 161 km. Three tracts lie about 19 km east of Breton National Wildlife Refuge. Two tracts are located about 13 km east of Delta Migratory Waterfowl Refuge and Pass-a-Loutre Game and Fish Preserve. Another tract lies approximately 21 km east of Grand Isle State Park. Additional tracts are scattered along the coast within 16 km of Russel Sage, Louisiana State, Paul Rainy, and Rockefeller Wildlife Refuges, and Rutherford and Hackberry beaches and Cheniere-au-Tigre State Park.

Those tracts located south of Texas are concentrated in the east. The tract nearest a recreational facility is one located approximately 23 kilometers east of Galveston and its beaches.

Barrier islands along eastern Louisiana and the Texas coast offer considerable protection to bays and estuaries against encroachment of offshore oil spills. These barrier islands and their beaches are a major recreational resource in their own right and oil spill damage could be significant. However, where wave action is strong the effects of an oil spill should be shorter lived on the outer beaches than in the bays and estuaries.

In general, if an oil spill did reach any shore or beach area, an unquantifiable amount of recreation could be curtailed for a period of several months; however, the probability of this occurring is considered remote for the area encompassed by the proposed sale.

### Impact on Aesthetic and Scenic Values

If air quality permits unlimited visibility, some portion of a 30 meter high offshore structure could be seen from the beach if it were located 27 kilometers or less from shore.

Sixteen of the tracts offered south of Louisiana are close enough to shore to permit observation of operations by someone on nearby beaches. In the Texas area, three of the tracts are near enough to shore to cause a visual impact.

The effects of visual impacts caused by the observation of structures resulting from this sale will be lessened because many offshore structures are already visible from the segments of coastline that would be affected by this sale. For example, at present there are approximately 50 structures visible from the Delta-Gulf Island NWR (Widner, 1975).

Any floating material such as debris or oil that is cast upon the beach or washed into a bay would constitute an impact upon the aesthetic values for users or owners of the area.

Even after burial of a pipeline, the remaining scars will cause an impact on the aesthetic values of the beach and associated shoreline. It is our estimation that the impact will endure for at least a year, or until sand has been redistributed by wind, tides, and rain and another growing season brings about revegetation.

Revegetation of dunes crossed by pipelines would reduce adverse effects from an aesthetic and scenic viewpoint and would decrease the chance of destruction of the dunes by erosion. However, it is not within the Federal Government's authority to require the revegetation of affected dunes unless they are on federal lands. State or local authorities may require revegetation of dunes disrupted by pipeline installations.

There will be an adverse impact on aesthetic values if any pipeline canals are constructed in marsh areas. The laying of a pipeline in these areas would result in an open canal or ditch through the marsh if they are not completely backfilled. However, this would be an add-on effect in much of the central Gulf region since there are at present numerous canals or ditches of this type.

There would be an adverse impact on aesthetic and scenic values resulting from construction of onshore terminal and produce storage facilities and pumping stations if these facilities are located in areas which are valued for their natural or scenic qualities. Some people will find the visual impact of these facilities aesthetically displeasing. There may also be noise pollution associated with vehicular traffic to and from these facilities and noise pollution resulting from pumping stations that would reduce the serene and natural qualities of an otherwise aesthetically enjoyable area.

The probability for the aforementioned impacts to occur is considered low. However, if any did occur, the duration would depend on numerous variables and the extent would be partly reflected in an individuals own values.

### Impact on Conservation Resources

The impact of oil spills and pipeline and onshore facility construction on biota, air and water quality, beaches, etc. has been discussed previously. Should an oil spill occur in a conservation area, or should pipeline and onshore facility construction occur in one of these areas, the impacts discussed above will apply.

As previously mentioned, Delta National Wildlife Refuge and Pass-a-Loutre State Refuge are near two oil prone tracts. With the occurrence of onshore winds, oil spills could reach these marshes in a few hours. It should be noted that the entire Louisiana coast is bordered by leased and developed tracts and the current offering represents a small, incremental increase in oil spill risk. The threat to conservation areas along the Texas coast as a result of this proposed sale is negligible.

### Impact on Historical and Archaeological Sites, Structures and Objects

Impacts on these features could stem from two sources. During an oil spill, any objects coated with oil would obviously be rendered less useful and valuable and may not survive cleaning operations. In addition, porous items such as wood, pottery or shell may be internally contaminated with oil and this might interfere with carbon dating procedures. Undiscovered archaeological sites or objects and shipwrecks may be destroyed during drilling, pipeline burial operations, or construction of terminal, storage or pumping facilities. (See section Mitigating Measures in the Proposed Action).

Degradation of the visual surroundings of a historical site could occur if onshore facilities or offshore platforms were constructed nearby. However, petroleum related facilities are commonplace sites in the general area and so in many places would not be considered as new intrusions on the visual aesthetics of the area.

It is not likely that presently known National Register sites will be adversely affected by activities resulting from this sale, either oil spills or construction of onshore facilities. Presently unknown sites may be discovered that might be affected.

### Impact on Sport Fishing and Recreational Boating

Although we have no conclusive evidence, it is our opinion that a major oil spill would adversely affect sport fishing and recreational boating. Boaters and fishermen would not want to soil their boats by entering a contaminated area for the duration of the spill incident.

Aside from damage caused by oil spills, there is considerable evidence that oil and gas operations have a favorable impact on sport fishing activities. One favorable impact is the result of sports fish concentration due to the artificial reef effect on offshore platforms. In the open sea, offshore platforms provide both food and cover in areas that are largely devoid of those essentials. Myriad forms of microorganisms in the water drift by these structures and attach themselves, soon encrusting all exposed surfaces on the platform.

Hard substrate is necessary for encrusting organisms: barnacles, hydroids, corals, mussels and other invertebrate organisms which serve as links in the food chain. Randall (1968) has stated that artificial reefs provide protection, food sources, spawning sites and spatial orientation markers for fishes. The same author found that artificial reefs attract available fish from surrounding waters, and increase the size of some populations by providing additional protected areas and food for both the young and adults. The typical platform located in 30 meters of water will have a surface area of about 0.8 hectares (over 8,082 square meters) (Shinn, 1974). Other advantages of these structures is the free movement of water through and around them and their high profile. The high profile provides habitat for a wide variety of fish ranging from the turbid dark bottom zone to the lighter and clearer surface waters. Platforms are easily located by boaters and fishermen and the platforms and their personnel are a source of emergency assistance for all offshore sportsmen.

Permanent platforms located near the top or slopes of small banks or reefs could reduce a fisherman's accessibility to the natural systems. Platforms may also recruit marine animals from the reef, thereby reducing the natural reef's potential as a fishing bank.

Offshore platforms are the major focus of sports divers from coastal Louisiana and may be expected to contribute significantly to the sport as their number increases in other areas of the Gulf. Divers are drawn to these structures for spear fishing, photography and general pleasure diving. The submerged portion of structures contribute to safety by assuring the divers' orientation to depth and distance (Estopinal, 1975).

It is expected that between 20 and 40 new platforms will be added as a result of this proposed sale to the more than 2055 in existence in the northern Gulf of Mexico (USGS, 1976).

## Other Impacts

### Induced Industrialization in the Coast Zone

#### INTRODUCTION

Although federal legislation influencing land use and refinery siting is presently under consideration, the federal government presently has little direct control over the spatial distribution of onshore activity induced on offshore production. This function, to the extent that it might exist, remains a state, regional or local responsibility.

The incremental and separable onshore effects attributable to this sale are difficult to identify and quantify because: (1) The proposed sale represents only a portion of a continuing activity in the coastal areas adjacent to the Gulf of Mexico. (2) The potential offshore production and onshore inducements resulting from this sale would probably coexist with interrelated, interdependent and potentially more dominant and overriding externalities such as the importation of foreign crude and the level of exploration and production activity onshore and in state waters. These activities might induce onshore responses similar to the onshore effects induced by activities on the outer continental shelf.

The quantities of crude oil and condensate currently produced from the various onshore and offshore areas have been included in the description of the petroleum industry in the Gulf of Mexico area.

#### BASIC OFFSHORE PRODUCTION DEVELOPMENT ASSUMPTIONS

After consultation with the Geological Survey, an estimated timetable and development sequence was used to determine the projected daily and annual production rate, and other aspects of the proposed sale's impact. This timetable is shown in Table L-1 and incorporates the following assumptions:

The number of exploratory rigs utilized would increase to a maximum of 15 during the year following the sale.

After a discovery has been made, the final platform design is completed, fabrication is completed and the platforms are installed during the second to fifth year.

At this time, development drilling is started and 300 producing wells on the platforms are drilled during the next year. Platform oil, gas and water treating facilities are installed after the wells are completed. According to this schedule, the first platform is installed during the second year and the last one is installed during the fifth year. Approximately 15-20 platform rigs might be required for drilling development wells.

Production can be started approximately two years after the first discovery if pipelines are installed with the first platform. Production was then modeled to increase during subsequent years and to reach a peak rate in the fifth year.

A summary of the anticipated development scheme with estimated expenditures is shown in Tables L-2 and L-3.

#### HYPOTHETICAL ONSHORE DEVELOPMENT SCHEME AND GENERAL LAND USE REQUIREMENTS

Portions of the Louisiana and Texas coasts have a developed, nearly self-contained gas and oil related infrastructure in the form of service, support, production, transportation, storage, Table L-1 Proposed Lease Sale 44: Hypothetical Development Timetable; High Estimate

| Year | Exploratory Wells | Platforms | Development Wells | Pipelines (kilometers) | Terminals |
|---|---|---|---|---|---|
| 0 | | | | | |
| 1 | 15 | 0 | 0 | | |
| 2 | 15 | 10 | 75 | 40 | |
| 3 | 15 | 10 | 75 | 41 | |
| 4 | 15 | 10 | 75 | 40 | |
| 5 | 15 | 10 | 75 | 40 | 2 |
| Totals | 75 | 40 | 300 | 161 | 2 |

Table L-2 The Expenditures Estimated [1/] to Result from Proposed Lease Sale 44 Range from Approximately $160 to $430 (million)

| Expenditures | Low Estimate | High Estimate |
|---|---|---|
| 1. Well drilling | | |
| Exploratory wells | $ 25,000,000 | $ 75,000,000 |
| Development wells | | |
| Productive | 80,000,000 | 240,000,000 |
| Total Well Drilling Costs | $105,000,000 | $315,000.000 |
| 2. Platforms | 40,000,000 | 80,000,000 |
| 3. Pipelines | 10,000,000 | 20,000,000 |
| 4. Terminal/Storage Facilities | 5,000,000 | 15,000,000 |
| Totals | $160,000,000 | $430,000,000 |

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[1/] Above table based on the following estimated costs.

Table L-2 (continued)

| | |
|---|---|
| Exploratory well | $1,000,000 |
| Development well | 800,000 |
| Platform | 2,000,000 |
| Terminal/Storage Facility | 7,500,000 |
| Pipeline (per mile) | 150,000 |

Table L-3 Proposed Lease Sale 44: Annual Summary of Investment; High Estimate (in millions of dollars)

| Year | Exploratory Wells | Platforms | Development Wells | Pipe-Lines | Terminals | Totals |
|---|---|---|---|---|---|---|
| 0 | | | | | | |
| 1 | 15.0 | | | | | 15.0 |
| 2 | 15.0 | 20.0 | 60.0 | 5.0 | 15.0 | 115.0 |
| 3 | 15.0 | 20.0 | 60.0 | 5.0 | | 100.0 |
| 4 | 15.0 | 20.0 | 60.0 | 5.0 | | 100.0 |
| 5 | 15.0 | 20.0 | 60.0 | 5.0 | | 100.0 |
| Totals | 75.0 | 80.0 | 240.0 | 20.0 | 15.0 | 430.0 |

processing, etc. facilities. The activities and facilities required by this proposed sale will therefore fall within the broad framework of similar activities and facilities in this and other proposed sales adjacent to the Gulf of Mexico.

The extent of the existing facilities in the Gulf of Mexico area have been previously described in Description of the Environment: History and Projected Economic Growth.

It is assumed that sale-induced support facilities will tend to locate in areas presently committed to and experiencing similar facilities and inducements. In general, the types and extent of existing land development are strong determinants in setting the pattern for future land development.

In particular, existing land development and activities related to the oil and gas industries are expected to be strong locational factors influencing sale related land use inducements. Areas presently committed to a highly developed gas and oil related infrastructure are expected to have a greater tendency towards, and land use precommitment to, expansion of these activities than will those areas with a low or non-existent level of development. Should new incremental requirements be induced by the proposed sale, they will essentially be an expansion of the present capabilities.

Sale inducements are generally not expected to overload this existing or historic capacity. Should the proposed sale cause incremental increases in any segment of the infrastructure, it is assumed that such increases will occur in presently industrialized areas, probably through more intense use of lands already dedicated to such uses.

Using the preceding estimates and general assumptions, the following development scheme and general land use requirements have been addressed: barging from production areas to shore; gas and oil pipeline development; oil transshipment; refinery construction, and onshore support facilities. Each of these activities has not been developed in detail because of the wide variety of economic conditions and the wide range of development alternatives available to the producers; however, the following is one realistic onshore development alternative. The estimates and land use assumptions have been developed for each major activity. These remain constant for any amount of production within broad daily ranges.

*Barging from production areas to shore*

Because of the anticipated production characteristics and weather constraints, no barging from production sites to onshore receiving facilities is anticipated. It has been assumed that pipelines would be installed early in the development program, and would be functional at the time of production, thus eliminating the need for this barging requirement.

*Gas and oil pipeline development*

The anticipated production resulting from this sale would be from tracts located offshore from the Louisiana coast and the upper coastal area of Texas. It would be necessary to install some offshore pipelines to link the new wells and production facilities to the existing offshore pipeline network. An estimated 161 kilometers of pipeline would be required for this purpose. To the extent that one of the interstate pipelines supplied from this area is currently curtailing deliveries, there should be spare onshore pipeline capacity to deliver part, if not all, of the new supplies resulting from the development to be included in this proposed sale.

*Oil transshipment*

It is assumed that all oil production will be pipelined to shore, stored in oil tank farms and finally transferred to existing refineries by means of existing pipelines or tanker and barge facilities.

*Possible refinery construction*

As discussed below, production from offshore areas will tend to offset declining onshore reserves. The total refinery and petrochemical capacities in the Texas and Louisiana coast has been and will continue to be in response to the region's need to supply crude oil and products to adjacent regions and to meet its own needs. This total will be derived independently of this proposed lease sale's possible contribution. Since this current capacity processes and will probably continue to process a combination of locally produced (onshore and offshore) and imported (domestic and foreign) crude oil, the capacity produced by this proposed sale is perceived to be inclusive of this total rather than constituting an additive factor.

The principal effect of this proposed sale on the industrial environment of the coastal areas of the Gulf of Mexico is believed to be the resulting tendency to preserve the existing industrial and economic activity in the region.

This conclusion is based on several factors, including: (a) The extensive industrial development in the area. These industries have developed over a period of many years, and have been based on existing reserves of oil and gas in the area. (b) The current decline in crude oil and condensate production in the coastal area of the Gulf of Mexico. (c) The importation of crude petroleum for refining in facilities located in the coastal zone.

The extensive existing refining capacity and petrochemical production facilities have been previously described in Description of Environment: History and Projected Economic Growth.

The extent to which crude oil and condensate produced from tracts leased as a result of this proposed sale will displace imported crude oil and condensate and will probably be dependent, in large part, on the relative price of domestic crude oil and imported crude oil.

The following comparisons are based on tables published in the January, 1976 issue of Monthly Energy Review, a publication of the Federal Energy Administration.

During March, 1975, approximately 60% of the domestic crude oil production was valued at the wellhead at $5.25 per barrel. This oil is referred to as old oil and is subject to price control. The remaining 34% of the total domestic crude oil production is referred to as uncontrolled oil and is sold at the free market price. Uncontrolled oil consists of new oil, released oil and oil produced from stripper wells. The price of new oil during October, 1975 was estimated to be $12.73 per barrel.

A preliminary estimate of the average cost for all domestic crude petroleum delivered to refiners during October was $8.59 per barrel. The refiner cost of imported crude petroleum was estimated to be $14.66 per barrel during October, 1975, or approximately $6.07 more than the refiner's average cost of domestic crude. A comparison of refiner acquisition cost of new oil with the landed cost of imported crude is difficult, due to the necessity of adding transportation costs to the wellhead price of new oil in order to arrive at a comparable cost to the refiner, but it appears probable that new domestic crude petroleum would be less costly than imported crude petroleum.

On December 22, 1975, the President signed into law the Energy Policy and Conservation Act, and at the same time removed the $2 per barrel fee on imported crude oil. Among other provisions, the Emergency Petroleum Allocation Act of 1973 has been amended to establish a composite ceiling price of $7.66 per barrel for all first sales of crude oil produced in the United States, beginning in February, 1976. The $7.66 can be increased at the discretion of the President, beginning in March, 1976, to adjust for inflation and to provide a production incentive of not more than three percent per year. However, both adjustments may not exceed 10% per year without the approval of Congress. The Act authorizes a gradual phase out of mandatory domestic price control on crude over a 40 month period.

The Federal Energy Administration (FEA, Monthly Energy Review, January, 1976) is currently preparing a program incorporating the new authorized prices applicable to newly developed oil production.

It is assumed that the additional production from tracts leased as a result of this proposed sale will displace imported crude petroleum, as well as replace the presently declining domestic crude oil production. This effect would not be anticipated to initiate an increase in refining capacity, but rather to continue the operation of the existing refineries in the Gulf of Mexico region.

*Support facilities, operating bases, etc.*

"Support facilities" are a wide variety of supply and service oriented industries having capabilities to support the exploration, production and transportation of gas and oil. It includes those companies dealing with tools, wireline, gas life, cement, boats, etc., as well as machine and welding shops, trucking firms, wellhead and mud suppliers, supply stores, etc. Such capability is present in many industrialized areas within the Louisiana and Texas coastal areas, and it has been assumed that capabilities exist in virtually all sectors which will be utilized by sale related demands. It is not anticipated that the proposed sale will create new demand for lands dedicated to these uses.

The individual and total sale induced acreage is assumed to be very small, and these requirements may be widely dispersed over large portions of the coastal zone. It can be assumed that the region has many sites which could host the modest acreage requirements, should development of the proposed sale be different from that assumed beforehand.

Industrial development was used as the basis for land use requirements, as its site demands are most relevent to sale related activities. However, in doing so, it is understood that this land use represents only one component of a balanced land use/population ration. New industrial development induces new employees and activities into the general sale area, and these will be distributed to more specific areas. This suggests land use implications beyond these specifically addressed because of requirements for residential, commercial, recreational and other land use categories.

Any population or industrial inducement can be perceived as creating environmental stress for a localized area or general region. Conversely, shifting or developmental pressure to such areas can be perceived as relieving stress in other areas. Whether the result is a net gain or loss of environmental stress, is partially dependent on the relative stresses experienced in the areas which gain or lose population, and, the capability of the receiving area to accomodate new development. It is axiomatic that stress induced into an area can often be mitigated by rationally developed, goal oriented policies and land use plans. Subsequent allocation of land in response to these demands remains a responsibility of state, regional and local governments. Because of the time lag between the proposed lease sale and the resulting land use impacts, there is sufficient lead time for these entities to develop responsive land use plans and policies.

### Economic Effects

The principal economic effects of the oil and gas produced as a result of this proposed sale are anticipated to be experienced in the states of Louisiana and Texas. After leasing, exploration and development activities have been completed, the exact geographic location in which economic activity will be most likely to result can be more precisely identified.

Oil and gas produced as a result of this proposed sale will become available at some time in the future, and the impact due to the economic activity resulting from this proposed sale will take place in the economic climate that exists at this time.

Currently, an increased number of rotary drilling rigs are in operation, with the total number of wells drilled during 1975 higher than the number of wells drilled during 1973 and 1974. Drilling capacity and competition for steel products may delay the development of the leases awarded as a result of this proposed sale, thereby causing a reduced annual economic effect that would otherwise be anticipated.

Although the quantities of oil and gas that may be produced from proposed Sale No. 44 are estimated to be incremental additions to the existing production of oil and gas on the Gulf of Mexico OCS, these sale related additions of 30,000 barrels of oil per day and 360 million cubic feet of gas per day would be significant.

During the month of September, 1975, crude petroleum production from the Louisiana offshore area amounted to 921,800 barrels per day, and crude petroleum production from offshore Texas amounted to 2,000 barrels per day. (USDI, 1975a).

In order for the additional quantities of oil and gas discovered as a result of proposed Sale No. 44 to become available to consumers, platforms would have to be constructed, wells would have to be drilled and pipelines linking the additional production facilities to existing transportation systems would be required.

This activity can be considered to be an extension or continuation of present employment and industrial patterns related to the existing petroleum based economy within the region.

However, some additional employment may be expected to result from the exploration, production and initial processing of crude oil and natural gas that might result from this proposed sale, and an estimate of this employment has been based on data published by the Bureau of the Census (1972).

This employment may be an addition to the work force already present in the states adjacent to the Gulf of Mexico, providing that a high level of drilling and production activity is maintained in other areas. In the event that surplus skilled labor is available within the required specialties, the impact of this proposed sale on employment in exploration and production related activities is seen to be a tendency to preserve the existing employment.

Additional employment impact, if it materializes, is anticipated to be experienced in the fields of oil and gas exploration, production and natural gas liquids treatment.

As a means of reporting employment and wage and salary payments, the Bureau of Census publishes a series of reports entitled, ''1972 Census of Mineral Industries''.

Data pertaining to employment in offshore oil and gas exploration and production activities during the year 1972 have been included in the section on History and Projected Economic Growth.

The data provided within MIC 72(1)-13A, Oil and Gas Field Operations, SIC 131, included tabulations of the number of offshore wells operated during December, 1972, as well as the number of wells drilled during the year. These data are summarized on Table L-4.

During the year 1972, approximately 5,100 persons were employed in offshore drilling activity (SIC 1381) adjacent to Texas and Louisiana. A comparison of this number of employees with the number of wells drilled in this area indicates a ratio of 6.72 employees per drilled well. During the second, third, fourth and fifth year following the proposed sale, 90 wells may be drilled, indicating a potential employment increase amounting to 605 jobs during those years.

During the month of December, 1972, there were 3,041 producing oil wells and 1,629 producing gas condensate wells located off the coasts of Louisiana and Texas. An additional 2,905 oil and gas condensate wells were classified as shut in during December, 1972. The total number of oil and gas condensate wells, both producing and shut-in, amounted to 7.575 wells.

Within the industry classification of SIC 1311 (Operating oil and gas field properties) and SIC 1389 (Miscellaneous oil and gas field services), approximately 7,500 persons were engaged in offshore activities.

Based on the relationship between the number of wells and the number of employees, a ratio of one employee for each well is suggested if all wells are included, or 1.6 employees per well if only the producing wells are included. The maximum of producing wells estimated to result from this sale is 300, and this number indicates that between 300 and 480 persons would be employed during the production phase.

An alternative method of estimating employment could be based on the production—employment ratio during 1972, with the application of this ratio to the production anticipated from this proposed sale. This procedure requires the determination of an equivalence between gas and oil production. If, for simplicity purposes, a comparison of employment is made only with the production of oil, then the 1972 total Gulf of Mexico offshore oil and condensate production of 455,619,000 barrels indicates an annual production of 60,749 barrels, or 1 employee for each 166 barrels of daily production. The estimated daily production from this proposed sale is estimated to amount to 30,000 barrels per day, resulting in an estimated employment effect of 181 jobs in SIC 1311 and SIC 1381. A figure of 320 individuals employed in sale related production activities is perhaps a reasonable estimate.

Those persons employed in establishments which are primarily engaged in producing liquid hydrocarbons from oil and gas field gases are enumerated in the applicable County Business Patterns under the category of SIC 132. Specific data on the number of establishments and the number of employees were published only for the states of Louisiana and Texas, although processing plants were noted as being present in the other coastal states. This employment is summarized on Table L-5.

The ratio of employees to billion cubic feet of natural gas processed per year, based on the total natural gas processed in the states of Texas and Louisiana, is 2.78 employees per billion cubic feet processed.

The natural gas production estimated to result from this proposed sale amounts to 360 million cubic feet of gas per day, or approximately 31.4 billion cubic feet per year, indicating an employment effect of approximately 87 jobs.

Estimations of the total direct employment which will result from exploration, production and natural gas processing as a result of this proposed lease sale amounts to approximately 1,012 persons:

| Category | Annual employment |
|---|---|
| Oil and gas well drilling | 605 |
| Oil and gas production | 320 |
| Natural gas liquids extraction | 87 |
| Total employment | 1,012 |

The average taxable wages paid within these classifications was calculated from the payroll data provided in the County Business Patterns, and are expressed in 1972 dollars paid during the first quarter of that year.

Total annual wages of the 605 employees of the drilling industries would amount to approximately $5 million dollars; the annual wages of the 320 employees during the production activities would

Table L-4

## 1. Wells Completed in Offshore Areas (1972)

| Area | Oil | Gas Condensate | Dry | Service | Total |
|---|---|---|---|---|---|
| Louisiana Offshore | 232 | 166 | 299 | 7 | 704 |
| Texas Offshore | 4 | 20 | 30 | 0 | 54 |
| Gulf of Mexico | 236 | 186 | 329 | 7 | 758 |
| California | 47 | 0 | 3 | 25 | 79 |
| Alaska | 4 | | | | |
| Total Offshore | 287 | 186 | 332 | 32 | 837 |

## 2. Wells Operated in Offshore Areas (December, 1972)

| | Producing | | Shut In | | |
|---|---|---|---|---|---|
| Area | Oil | Gas/Cond. | Oil | Gas/Cond. | Total |
| Louisiana Offshore | 3,021 | 1,512 | 2,086 | 741 | 7,360 |
| Texas Offshore | 20 | 117 | 18 | 60 | 215 |
| Gulf Mexico | 3,041 | 1,629 | 2,104 | 801 | 7,575 |
| California | 1,482 | 11 | 370 | 8 | 1,871 |
| Alaska | 113 | 3 | 12 | 2 | 130 |
| Total Offshore | 4,636 | 1,643 | 2,486 | 811 | 9,576 |

Source: Census of Mineral Industries (1972)

Table L-5 Number of Liquid Hydrocarbon Producing Units and Employment - 1970

| State | Number of Reporting Units | Number of Employees |
|---|---|---|
| Louisiana | 51 | 973 |
| Texas | 111 | 4,219 |
| Totals | 162 | 5,192 |
| Total U. S. | 255 | 7,320 |

| State | | Natural Gas Processed (Billion cubic feet) |
|---|---|---|
| Louisiana | | 6,337.3 |
| Texas | | 8,139.3 |
| | Total | 14,476.7 |

Source: County Business Patterns
Bureau of the Census

amount to approximately $3.5 million dollars, and the annual payroll of employees of the natural gas processing industry would amount to approximately $1 million dollars. The total payroll of the 1,012 employees is estimated to amount to approximately $10 million (1972 dollars).

Persons directly employed in operations relative to the exploration and production of oil and gas can be expected to spend their wage and salary income for purchases of goods and services.

The provision of these goods and services will require the employment of other persons. The number of persons employed in support industries would be dependent on both the consumption patterns of those directly employed, as well as the extent to which labor within an economic system was engaged in the production of goods for consumption within the same system. Since a wage or salary worker would be expected to meet the largest portion of his needs within the area of his residence, the expenditure of wage and salary payments for items produced outside of the local economy would be expected to generate additional support employment in the area in which the item was produced.

The value of the wage and salary payments made to the persons employed in support activities has been determined by calculating an average wage and salary payment for the two state area from data included within the applicable County Business Patterns publications as shown in Table L-6.

The number of persons employed in support industries, or the employment induced in other sectors of the economy shown by increases of employment in basic industries has been treated in Offshore Revenue Sharing, a publication prepared by the Gulf South Research Institute of Baton Rouge, Louisiana and the Structure of the Texas Economy, prepared by Herbert W. Grubb of the Office of Information Services in March, 1973. A paper prepared by Dr. Grubb in 1972, entitled, ‘‘Economic Aspects of the Petroleum Industries of the Texas Economy’’ contained some data for determining the induced employment which results from oil related activities.

The economic impact of a million dollar change in output of petroleum refining is shown to be $2.56 million. This represents the direct value of output from these industries plus the indirect effects from other related industries, as well as the induced effects of the changes in income of the wage and salary earners (households) involved. Each million dollar in output of crude is estimated to employ 50 workers within the economy, of which 11 are employed directly in oil field work and 39 are employed in the support and induced industries. (Grubb, 1972). This estimate indicates that 3.5 persons are employed in support and induced industries for every person directly employed in oil field work.

In Offshore Revenue Sharing, the primary employment estimated to result from OCS activity amounted to 40,300 persons engaged in activities within the categories of mining, manufacturing, construction, chemicals and allied products and refining. The supporting employment was estimated to amount to 84,100 persons, indicating a relationship of approximately 2.08 persons employed in support industries for every person employed in the petroleum related industries.

For the purpose of estimating impact that may result from this proposed sale, employment in support industries will be based on an estimated 2.1 persons employed for every person employed in the basic oil related sectors.

Since direct employment is estimated to amount to 1,012 persons during the years of peak activity, the induced employment during these years can be estimated to amount to an additional 2,125 persons. Based on an average annual wage or salary of approximately $6,654 in 1972 dollars, estimations of total wage and salary payments will amount to approximately $14 million in 1972 dollars.

Additional employment can be anticipated as a result of the required construction of pipelines, production platforms and other facilities. It is anticipated that the economic stimulus that may result from these activities will be experienced primarily in the states of Louisiana and Texas.

Standard Industrial Classification 3533, Oil Field Machinery and Equipment, includes establishments primarily engaged in manufacturing machinery and equipment for use in oil and gas fields or for drilling water wells. This classification includes the manufactures of rock bits, derricks and rigs, drilling tools, oil and gas machinery and equipment.

The relative importance of this industry in the Gulf of Mexico area is apparent. Of a total U.S. employment of 35,915 in this industry, approximately 20,000 are employed in the state of Texas and an additional 1,607 in the state of Louisiana.

### Estimated Income of Persons Employed by Oil and Gas Support Industries in the Gulf of Mexico Region

Table L-6

| State | Total Taxable payrolls Mid March 1972 (Thousands) | Number of Employees Mid March 1972 | Taxable Payroll: per employee Per Quarter | Taxable Payroll: per employee Annual |
|---|---|---|---|---|
| Louisiana | $1,419,694 | 852,793 | $1,664.75 | $6,659.00 |
| Texas | 5,195,118 | 3,125,175 | 1,662.34 | 6,649.36 |
| Totals | $6,614,812 | 3,977,968 | | |
| Two State Average | | | $1,663.54 | $6,654.18 |
| United States | $108,084,852 | 58,015,904 | $1,863.02 | $7,452.08 |

Source: County Business Patterns
Bureau of the Census

The construction and installation of fixed production platforms required by this proposed sale will probably be accomplished in existing Gulf of Mexico facilities.

The National Petroleum Council, in response to a request from the Department of the Interior, undertook a study to forecast the availability of materials, manpower and equipment necessary for exploration and production of oil. The results of this study are contained in Availability of Materials, Manpower and Equipment for the Exploration, Drilling and Production of Oil 1974-1976 (National Petroleum Council, 1974). In reference to the construction of platforms, this study concluded that the total platform requirements would be 50 platforms (150,000 tons) during 1974, 55 platforms (176,000 tons) during 1975 and 60 platforms (204,000 tons) during 1976. Contractors indicated that present yard facilities are capable of producing approximately 200,000 tons, with steel availability cited as the primary limitation to production. Present expansion plans will increase yard capabilities over the next two years so that the physical plant should not be a constraint on production through 1976.

The crude hydrocarbons produced as a result of this proposed sale will probably receive further processing within existing facilities in the Gulf of Mexico area. Facilities such as refineries, existing crude oil and natural gas gathering and transportation systems and petrochemical plants will be utilized to the maximum extent possible, and it is anticipated that additional facilities of this type will not result from this proposed sale.

In summary, it appears probable that oil and gas produced as a result of this proposed sale will provide for the continuation of existing patterns of employment in those areas adjacent to the Gulf of Mexico where the industrial infrastructure related to the oil and gas industry is established. Activities such as the construction of drilling equipment and the necessary foundation and production facilities will probably be accomplished in existing manufacturing facilities.

The impact of this proposed sale may result in a possible increase in the employment of persons directly engaged in activities related to drilling and production, and in the number of additional persons employed in secondary and tertiary support industries.

The total annual employment that may be expected from this proposed sale amounts to approximately 3,137 persons, with 1,012 persons directly employed and 2,125 persons indirectly receiving employment as a result of the expenditures of the first group. These peak employment effects would be present when drilling and production activities were being conducted simultaneously.

Among the data prepared and published by the Bureau of the Census are tables presenting the last occupation of the experienced unemployed. These data are significant in providing some insight as to the number of persons who are already present in an area that may become employed as a direct or indirect result of petroleum related activity on the outer continental shelf. Additional stress on a region may be mitigated to the extent that persons already within the area are employed, rather than additional persons migrating to the area as a consequence of OCS operations.

Table L-7 summarizes the Bureau of Census data on a statewide basis for 1970. The figures shown apply to male and female workers 16 years of age and older, and they also include persons who were employed most recently for the ten years prior to the 1970 census.

Table L-7

## Employment Data for the Gulf of Mexico Region - 1970

Texas

| Occupation | Male | Female | Total |
|---|---|---|---|
| Professional, managerial and technical | 6,823 | 5,343 | |
| Sales workers | 3,671 | 6,141 | |
| Clerical and kindred workers | 4,239 | 18,342 | |
| Craftsmen, foremen and kindred | 17,445 | ND | |
| Operatives, including transport | 18,790 | 11,233 | |
| Laborers, except farm | 12,956 | ND | |
| Farm workers | 4,388 | 1,317 | |
| Service workers, including private household | 7,772 | 14,348 | |
| Other blue collar | ND | 2,585 | |
| Service workers, except private household | ND | ND | |
| Private household workers | ND | 4,549 | |
| Total | 76,649 | 66,524 | 143,173 |

Louisiana

| Occupation | Male | Female | Total |
|---|---|---|---|
| Professional, managerial and technical | 2,580 | 1,820 | |
| Sales workers | 1,043 | 1,891 | |
| Clerical and kindred | 1,642 | 5,520 | |
| Craftsmen, foremen and kindred | 9,420 | ND | |
| Operatives, including transport | 9,533 | 3,216 | |
| Laborers, except farm | 6,884 | ND | |
| Farm workers | 1,558 | 380 | |
| Service workers, including private household | 3,007 | ND | |
| Other blue collar | ND | 969 | |
| Service workers, except private household | ND | 5,126 | |
| Private household workers | ND | 3,183 | |
| Total | 35,925 | 23,164 | 59,089 |

Source: Bureau of the Census

## Matrix Analysis of Potential Impacts on Major Resources and Activities

### Purpose

The purpose of this matrix analysis is to analyze some of the potential impacts of the proposed OCS lease sale by way of a matrix analytical technique in an attempt to provide the decision-maker and reviewer with an array of factors which must be considered in order to form value judgements concerning the importance of these interactions.

In this section, each tract is included in a table designed to describe its distance from shore, water depth and expected type of production. In addition, the sensitivity of major resources and activities to impacts of oil spills, should one occur, and to impacts of structures, should the tract be developed, is evaluated by means of a sensitivity rating for both spills and structures.

### Significant Resource Factors

The matrix analysis examines major resource categories which could sustain negative impacts as a result of the development of the tracts included in the proposed lease sale. Significant resource factors appear on the horizontal axis of each matrix and for purposes of this analysis have been identified to consist of:

littoral systems
reefal systems
benthic systems
endangered species
commercial and sport fishing
shipping
aesthetics
outdoor recreation
cultural resources

All evaluations of the above categories were based on measurement from the edge of the tract closest to the resource potentially affected.

### Impact Producing Factors

This evaluation considers the sensitivity of significant resources and activities to the occurrence of oil spills and structures within the proposed sale area as being the primary factor. ‘‘Oil spills’’ in this context refers to spills of 100,000 gallons (2,381 bbls) or more (the volume designated as a major spill by the National Oil and Hazardous Substances Pollution Contingency Plan), and structures include platforms or other fixed structures and artificial islands.

Other impact-producing factors, such as debris resulting from drilling activities, and pipeline construction, cannot be analyzed on a tract-by-tract basis, and therefore, are not included in this matrix section. However, these and other related factors were discussed on the basis of this proposed sale in the Environmental Impact of the Proposed Sale Section.

### Sensitivity Rating

Each tract has been assigned sensitivity values for oil spills and structures based primarily on the distance from a particular resource.

A series of scales have been devised for the purpose of assigning a range of values to indicate sensitivity to each impact-producing factor. These scales are presented below and consist of three levels of potential magnitude of impact.

3—Maximal potential impact
2—Moderate potential impact
1—Minimal potential impact

The judgement of the importance of any specific impact is at the discretion of the decision-maker or reviewer.

#### STRUCTURES

An estimate of the importance of the impact of structures on the environment consist of two factors: quantity-in this case, it is estimated that all tracts 2,023 hectares or more in size will average two structures per tract, even though some tracts may never be developed, and time-all structures will remain on site for an average period of fifteen to twenty years.

Structures are considered to be potentially negative impacts to four of the significant resource factors mentioned previously: reefal systems, commercial and sport fishing, shipping and aesthetics.

Reefal systems containing coral and associated organisms are very sensitive to disturbances such as the turbidity created by the discharge of drill muds and cuttings. Also, nektonic population distribution may be affected by the presence of a structure. Therefore, the sensitivity ratings for reefal systems reflects these considerations and is purposely conservative due to our lack of information with regard to the distribution of drill muds and cuttings under operational conditions in marine systems.

Structures interfere with commercial fishing by removing trawling and purse seining areas. Approximately 70 percent of the catch by these two methods in the Gulf of Mexico is shoreward of the 20 meter isobath. The remainder of the catch by these methods is concentrated between the 20 meter and the 200 meter isobath with only nominal effort expended beyond these depths.

Structures pose a collision hazard to shipping and boating in general but are especially hazardous when placed near fairways or anchorage areas and are rated accordingly.

The aesthetic sensitivity ratings are based on the visibility from sea level of a 110 foot tall structure. Within 10 miles of shore, such a structure would be obvious, whereas 11 to 15 miles from shore the structure would be hardly visible and greater than 15 miles from shore the aesthetic impact would be negligible except from the point of view of the boating community.

The above considerations resulted in the following sensitivity rating for structures:

### Structures

Reefal systems
  3—one mile or less from known reef
  2—one to three miles from known reef
  1—greater than three miles from known reef
Commercial fishing
  3—within 20 meter depth contour
  2—within 200 meter depth contour
  1—outside 200 meter depth contour
Shipping
  3—within 1 mile of fairway or anchorage
  2—1 to 3 miles of fairway or anchorage
  1—greater than 3 miles from fairway or anchorage
Aesthetics
  3—within 10 miles of shore
  2—11 to 15 miles from shore
  1—greater than 15 miles from shore

### Oil spills

The same two factors for estimating the importance of oil spills on the environment are as follows: quantity—our analysis is based on all spills of 100,000 gallons or more (2,381 bbls), and time—the toxicity of oil is known to decrease with weathering time which depends on the rate of travel of an oil slick. For analytical purposes, we have assumed a rate of 0.5 knots which for weathering times of 24, 48 and 72 hours gives impact zones of 12, 24, and 36 nautical miles. Using toxicity at 24 hours as a base, laboratory bioassays indicate a decrease in toxicity by a factor of 0.90 for 48 hour weathering and 0.54 for 72 hours weathering (R. P. Hannah, personal communication). Therefore, assigned sensitivity values of biological systems are adjusted for distance from a potential spill site by the appropriate weathering factor.

Oil spills are considered to be potentially damaging to all of the previously listed resource factors except shipping.

If a spill were to occur within 10 miles of any resource, it probably could not be effectively contained before contacting the resources. For this reason, the highest sensitivity rating was established for 10 miles or less from littoral systems, reefal systems, endangered species, aesthetics, outdoor recreation and cultural resources. Within 11 to 20 miles the probability that oil would contact a resource is sufficient enough to warrant concern. Beyond 20 miles the possibility of contact still exists but is considered to be minimal.

The sensitivity ratings for benthic systems and sport and commercial fishing is based upon depths to which oil can be expected to be entrained in the Gulf of Mexico. In nearshore areas 10 meters or less in depth, a spill will almost certainly contact bottom sediments increasing the potential for damage to benthic systems and tainting of demersal fish species. Under extreme conditions of mixing energy, the depth to which oil might be entrained can be assumed to be 20 meters or less. Sediments at depths greater than 20 meters have little chance of being contaminated with the exception of the immediate vicinity of the spill site.

Based on the above assumptions the sensitivity scale for oil spills was developed (Table M-1).

### Summary of Matrix Analysis

The matrix presents the impact of structures and oil spills upon applicable resources and activities based on the sensitivity scales and in the case of oil spills weathering as it applies to potential impact upon living resources (See Matrix Analysis Table M-2).

Impact upon individual resource categories are totaled resulting in a cumulative impact. This is divided by the total possible resulting in an impact index. For example, tract number three has a cumulative impact for structures of eight out of 12 possible for an impact index of .67 for structures. The same tract has a cumulative impact rating of 15 for oil spills out of a total possible of 24 for an impact index of .63. These are summed for an additive impact of 1.30.

The impact index and additive impact ratings can be evaluated as follows:

Impact Index
  1.00-0.78 Maximal potential impact
  0.77-0.56 Moderate potential impact

0.55-0.33 Minimal potential impact
Additive Impact
2.00-1.44 Maximal potential impact
1.43-0.89 Moderate potential impact
0.88-0.33 Minimal potential impact

Table M-1 Oil Spills

Littoral system
- 3 - within 10 miles of shore
- 2 - 11-20 miles from shore
- 1 - greater than 20 miles from shore.

Reefal system
- 3 - within 10 miles of reef
- 2 - 11-20 miles from reef
- 1 - greater than 20 miles from reef

Benthic system
- 3 - 10 meters depth or less
- 2 - 11-20 meters depth
- 1 - greater than 20 meters depth

Endangered species
- 3 - within 10 miles of known habitat
- 2 - 11-20 miles from known habitat
- 1 - greater than 20 miles from known habitat

Sport and Commercial fishing
- 3 - 10 meters depth or less
- 2 - 11-20 meters depth
- 1 - greater than 20 meters depth

Aesthetics
- 3 - within 10 miles of shore
- 2 - 11-20 miles from shore
- 1 - greater than 20 miles from shore

Outdoor recreation
- 3 - within 10 miles of shore
- 2 - 11-20 miles from shore
- 1 - greater than 20 miles from shore

Cultural resources
- 3 - within 10 miles of shore
- 2 - 11-20 miles from shore
- 1 - greater than 20 miles from shore

Table M-2 MATRIX ANALYSES TABLES

Lease area identification:

BS - Brazos - South Addition
G - Galveston
HI - High Island
HIE - High Island - East Addition
HES - High Island - East Addition - South Extension
WC - West Cameron
WCS - West Cameron - South Addition
ECS - East Cameron - South Addition
V - Vermilion
VS - Vermilion - South Addition
SMI - South Marsh Island
SMS - South Marsh Island - South Addition
SMN - South Marsh Island - North Addition
EI - Eugene Island
EIS - Eugene Island - South Addition
SS - Ship Shoal
ST - South Timbalier
WD - West Delta
SP - South Pass
MP - Main Pass
MSE - Main Pass - South & East Addition
MS2 - Mobile South No. 2

Code for abbreviations on matrix tables:

G - Gas prone tract
O&G - Oil and gas prone tract
O - Oil prone tract
NA - Not Applicable
/ - Upper portion of each block pertains to impact from structures, lower portion pertains to impacts from possible oil spills.

# Table M-2. Matrix Analysis Table

| TRACT DATA | | | | RESOURCES AND ACTIVITIES | | | | | | | | | IMPACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tract Number Lease Block Location 1/ | Distance from Shore (miles) | Approximate Depth (meters) | Estimated Type of Production | Littoral Systems | Reefal Systems | Benthic Systems | Endangered Species | Sport and Commercial Fishing | Shipping | Aesthetics | Outdoor Recreation | Cultural Resources | Cumulative Impact | Impact Index | Additive Impact |
| 1 BS A-104 | 22 | 57 | G | NA | 1 | NA | NA | 2 | 2 | 1 | NA | NA | 6 | 0.50 | 0.50 |
| 2 G 144 | 11 | 14 | C | NA | 1 | NA | NA | 3 | 3 | 2 | NA | NA | 9 | 0.75 | 0.75 |
| 3 HI 109 | 14 | 14 | O&C | NA<br>2 | 1<br>1 | NA<br>2 | NA<br>2 | 3<br>2 | 2<br>NA | 2<br>2 | NA<br>2 | NA<br>2 | 8<br>15 | 0.67<br>0.63 | 1.30 |
| 4 HI 141 | 15 | 15 | C | NA | 1 | NA | NA | 3 | 3 | 2 | NA | NA | 9 | 0.75 | 0.75 |
| 5 HIE A-228 | 34 | 27 | C | NA | 1 | NA | NA | 2 | 3 | 1 | NA | NA | 7 | 0.58 | 0.58 |
| 6 HES A-281 | 44 | 52 | G | NA | 1 | NA | NA | 2 | 1 | 1 | NA | NA | 5 | 0.42 | 0.42 |

1/ Tract designations in the matrix analysis table are listed by tract number followed by the lease block location. Appendix A presents a detailed description of each tract.

| TRACT DATA | | | | RESOURCES AND ACTIVITIES | | | | | | | | | IMPACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tract Number Lease Block Location | Distance from Shore (miles) | Approximate Depth (meters) | Estimated Type of Production | Littoral Systems | Reefal Systems | Benthic Systems | Endangered Species | Sport and Commercial Fishing | Shipping | Aesthetics | Outdoor Recreation | Cultural Resources | Cumulative Impact | Impact Index | Additive Impact |
| 7 HES A-310 | 50 | 64 | C | NA | 1 | NA | NA | 2 | 1 | 1 | NA | NA | 5 | 0.42 | 0.42 |
| 8 WC 69 | 9 | 11 | G | NA | 1 | NA | NA | 3 | 1 | 3 | NA | NA | 8 | 0.67 | 0.67 |
| 9 WC 103 | 12 | 12 | G | NA | 1 | NA | NA | 3 | 1 | 2 | NA | NA | 7 | 0.58 | 0.58 |
| 10 WC 134 | 18 | 12 | C | NA | 1 | NA | NA | 3 | 1 | 1 | NA | NA | 6 | 0.50 | 0.50 |
| 11 WC 170 | 22 | 11 | C | NA | 1 | NA | NA | 2 | 1 | 1 | NA | NA | 5 | 0.42 | 0.50 |
| 12 WC 264 | 42 | 24 | G | NA | | NA | NA | | | | NA | NA | | | 0.42 |

| TRACT DATA | | | | RESOURCES AND ACTIVITIES | | | | | | | | | IMPACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tract Number Lease Block Location | Distance from Shore (miles) | Approximate Depth (meters) | Estimated Type of Production | Littoral Systems | Reefal Systems | Benthic Systems | Endangered Species | Sport and Commercial Fishing | Shipping | Aesthetics | Outdoor Recreation | Cultural Resources | Cumulative Impact | Impact Index | Additive Impact |
| 13 WC 270 | 48 | 27 | C | NA | 1 | NA | NA | 2 | 1 | 1 | NA | NA | 5 | 0.42 | 0 42 |
| 14 WCS 455 | 67 | 36 | C | NA | 1 | NA | NA | 2 | 2 | 1 | NA | NA | 6 | 0.50 | 0.50 |
| 15 WCS 459 | 64 | 39 | C | NA | 1 | NA | NA | 2 | 2 | 1 | NA | NA | 6 | 0.50 | 0.50 |
| 16 WCS 460 | 71 | 39 | C | NA | 1 | NA | NA | 2 | 3 | 1 | NA | NA | 7 | 0.58 | 0.58 |
| 17 WCS 506 | 77 | 43 | G | NA | 1 | NA | NA | 2 | 3 | 1 | NA | NA | 7 | 0.58 | 0.58 |
| 18 WCS 507 | 79 | 46 | C | NA | 1 | NA | NA | 2 | 3 | 1 | NA | NA | 7 | 0.58 | 0.58 |

| TRACT DATA | | | | RESOURCES AND ACTIVITIES | | | | | | | | | IMPACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tract Number Lease Block Location | Distance from Shore (miles) | Approximate Depth (meters) | Estimated Type of Production | Littoral Systems | Reefal Systems | Benthic Systems | Endangered Species | Sport and Commercial Fishing | Shipping | Aesthetics | Outdoor Recreation | Cultural Resources | Cumulative Impact | Impact Index | Additive Impact |
| 19 WCS 528 | 90 | 54 | C | NA | 1 | NA | NA | 2 | 3 | 1 | NA | NA | 7 | 0.58 | 0.58 |
| 20 WCS 539 | 98 | 75 | G | NA | 1 | NA | NA | 2 | 1 | 1 | NA | NA | 5 | 0.42 | 0.42 |
| 21 WCS 601 | 109 | 78 | G | NA | 1 | NA | NA | 2 | 1 | 1 | NA | NA | 5 | 0.42 | 0.42 |
| 22 ECS 333 | 100 | 75 | G | NA | 1 | NA | NA | 2 | 3 | 1 | NA | NA | 7 | 0.58 | 0.58 |
| 23 ECS 336 | 103 | 78 | C | NA | 1 | NA | NA | 2 | 2 | 1 | NA | NA | 6 | 0.50 | 0.50 |
| 24 ECS 340 | 101 | 78 | C | NA | 1 | NA | NA | 2 | 3 | 1 | NA | NA | 7 | 0.58 | 0.58 |

Table M-2 Continued

| TRACT DATA | | | | RESOURCES AND ACTIVITIES | | | | | | | | | IMPACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tract Number Lease Block Location | Distance from Shore (miles) | Approximate Depth (meters) | Estimated Type of Production | Littoral Systems | Reefal Systems | Benthic Systems | Endangered Species | Sport and Commercial Fishing | Shipping | Aesthetics | Outdoor Recreation | Cultural Resources | Cumulative Impact | Impact Index | Additive Impact |
| V<br>25 25 | 5 | 8 | G | NA | 1 | NA | NA | 3 | 1 | 3 | NA | NA | 8 | 0.67 | 0.67 |
| U<br>26 37 | 7 | 11 | G | NA | 1 | NA | NA | 3 | 1 | 3 | NA | NA | 8 | 0.67 | 0.67 |
| V<br>27 50 | 8 | 5 | G | NA | 1 | NA | NA | 3 | 2 | 3 | NA | NA | 9 | 0.75 | 0.75 |
| U<br>28 102 | 24 | 20 | G | NA | 1 | NA | NA | 3 | 1 | 1 | NA | NA | 6 | 0.50 | 0.50 |
| V<br>29 146 | 32 | 24 | G | NA | 1 | NA | NA | 2 | 1 | 1 | NA | NA | 5 | 0.42 | 0.42 |
| V<br>30 156 | 34 | 25 | G | NA | 1 | NA | NA | 2 | 1 | 1 | NA | NA | 5 | 0.42 | 0.42 |

| TRACT DATA | | | | RESOURCES AND ACTIVITIES | | | | | | | | | IMPACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tract Number Lease Block Locstion | Distsnce from Shore (miles) | Approximate Depth (meters) | Estimated Type of Production | Littoral Systems | Reefal Systems | Benthic Systems | Endsngered Species | Sport snd Commercisl Fishing | Shipping | Aesthetics | Outdoor Recreation | Cultural Resources | Cumulative Impact | Impact Index | Additive Impact |
| U<br>31 160 | 35 | 27 | G | NA | 1 | NA | NA | 2 | 1<br>NA | 1 | NA | NA | 5 | 0.42 | 0.42 |
| U<br>32 163 | 38 | 28 | G | NA | 1 | NA | NA | 2 | 1<br>NA | 1 | NA | NA | 5 | 0.42 | 0.42 |
| US<br>33 277 | 76 | 55 | G | NA | 1 | NA | NA | 2 | 1<br>NA | 1 | NA | NA | 5 | 0.42 | 0.42 |
| US<br>34 286 | 78 | 57 | G | NA | 2 | NA | NA | 2 | 1<br>NA | 1 | NA | NA | 6 | 0.50 | 0.50 |
| US<br>35 310 | 83 | 63 | G | NA | 1 | NA | NA | 2 | 1<br>NA | 1 | NA | NA | 5 | 0.42 | 0.42 |
| SMI<br>36 8 | 30 | 20 | O&G | NA<br>0.90 | 1<br>0.90 | NA<br>1.80 | NA<br>0.90 | 3<br>2 | 1<br>NA | 1<br>1 | NA<br>1 | NA<br>1 | 6<br>9.5 | 0.50<br>0.40 | 0.90 |

| TRACT DATA | | | | RESOURCES AND ACTIVITIES | | | | | | | | | IMPACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tract Number Lease Block Locstion | Distance from Shore (miles) | Approximate Depth (meters) | Estimated Type of Production | Littoral Systems | Reefal Systems | Benthic Systems | Endsngered Species | Sport and Commercial Fishing | Shipping | Aesthetics | Outdoor Recreation | Cultural Resources | Cumulative Impact | Impact Index | Additive Impact |
| SMS<br>37 183 | 98 | 114 | G | NA | 3 | NA | NA | 1 | 1<br>NA | 1 | NA | NA | 6 | 0.50 | 0.50 |
| SMN<br>38 273 | 27 | 12 | G | NA | 1 | NA | NA | 3 | 1<br>NA | 1 | NA | NA | 6 | 0.50 | 0.50 |
| SMN<br>39 276 | 32 | 15 | G | NA | 1 | NA | NA | 3 | 1<br>NA | 1 | NA | NA | 6 | 0.50 | 0.50 |
| EI<br>40 37 | 3 | 3 | G | NA | 1 | NA | NA | 3 | 2<br>NA | 3 | NA | NA | 9 | 0.75 | 0.75 |
| EI<br>41 229 | 40 | 37 | G | NA | 1 | NA | NA | 2 | 1<br>NA | – | NA | NA | 5 | 0.42 | 0.42 |
| EIS<br>42 301 | 62 | 61 | G | NA | 1 | NA | NA | 2 | 1<br>NA | 1 | NA | NA | 5 | 0.42 | 0.42 |

| TRACT DATA | | | | RESOURCES AND ACTIVITIES | | | | | | | | | IMPACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tract Number Lesse Block Locstion | Distance from Shore (miles) | Approximate Depth (meters) | Estimated Type of Production | Littoral Systems | Reefal Systems | Benthic Systems | Endsngered Species | Sport and Commercial Fishing | Shipping | Aesthetica | Outdoor Recreation | Cultural Resources | Cumulative Impact | Impact Index | Additive Impact |
| EIS<br>43 302 | 62 | 67 | G | NA | 1 | NA | NA | 2 | 1 | 1 | NA | NA | 5 | 0.42 | 0.42 |
| EIS<br>44 310 | 62 | 68 | O&G | NA<br>0.54 | 1<br>0.54 | NA<br>0.54 | NA<br>0.54 | 2<br>1 | 1<br>NA | 1<br>1 | NA<br>1 | NA<br>1 | 5<br>6.2 | 0.42<br>0.26 | 0.68 |
| EIS<br>45 311 | 70 | 67 | O&G | NA<br>0.54 | 1<br>0.54 | NA<br>0.54 | NA<br>0.54 | 2<br>1 | 1<br>NA | 1<br>1 | NA<br>1 | NA<br>1 | 5<br>6.2 | 0.42<br>0.26 | 0.68 |
| EIS<br>46 351 | 72 | 90 | G | NA | 1 | NA | NA | 2 | 1 | 1 | NA | NA | 5 | 0.42 | 0.42 |
| EIS<br>47 352 | 72 | 86 | G | NA | 1 | NA | NA | 2 | 1 | 1 | NA | NA | 5 | 0.42 | 0.42 |
| SS<br>48 15 | 3 | 3 | G | NA | 1 | NA | NA | 3 | 1 | 3 | NA | NA | 8 | 0.67 | 0.67 |

Table M-2 (continued)

| TRACT DATA | | | | RESOURCES AND ACTIVITIES | | | | | | | | | IMPACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tract Number Lease Block Location | Distance from Shore (miles) | Approximate Depth (meters) | Estimated Type of Production | Littoral Systems | Reefal Systems | Benthic Systems | Endangered Species | Sport and Commercial Fishing | Shipping | Aesthetics | Outdoor Recreation | Cultural Resources | Cumulative Impact | Impact Index | Additive Impact |
| 49 SS 36 | 3 | 3 | G | NA | 1 | NA | NA | 3 | 1<br>NA | 3 | NA | NA | 8 | 0.67 | 0.67 |
| 50 SS 111 | 17 | 10 | G | NA | 1 | NA | NA | 3 | 1<br>NA | 1 | NA | NA | 6 | 0.50 | 0.50 |
| 51 SS 213 | 32 | 33 | O&G | NA<br>0.90 | 1<br>0.90 | NA<br>0.90 | NA<br>0.90 | 2<br>1 | 1<br>NA | 1<br>1 | NA<br>1 | NA<br>1 | 5<br>7.6 | 0.42<br>0.32 | 0.74 |
| 52 SS 232 | 34 | 38 | O&G | NA<br>0.90 | 1<br>0.90 | NA<br>0.90 | NA<br>0.90 | 2<br>1 | 1<br>NA | 1<br>1 | NA<br>1 | NA<br>1 | 5<br>7.6 | 0.42<br>0.32 | 0.74 |
| 53 ST 182 | 33 | 38 | O&G | NA<br>0.90 | 1<br>3 | NA<br>0.90 | NA<br>0.90 | 2<br>1 | 1<br>NA | 1<br>1 | NA<br>1 | NA<br>1 | 5<br>9.7 | 0.42<br>0.40 | 0.82 |
| 54 WD 34 | 10 | 18 | O&G | NA<br>3 | 1<br>1 | NA<br>2 | NA<br>3 | 3<br>2 | 1<br>NA | 3<br>3 | NA<br>3 | NA<br>3 | 8<br>20 | 0.67<br>0.83 | 1.50 |

| TRACT DATA | | | | RESOURCES AND ACTIVITIES | | | | | | | | | IMPACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tract Number Lease Block Location | Distance from Shore (miles) | Approximate Depth (meters) | Eatimated Type of Production | Littoral Systems | Reefal Systems | Benthic Systems | Endangered Species | Sport and Commercial Fishing | Shipping | Aesthetics | Outdoor Recreation | Cultural Resources | Cumulativa Impact | Impact Index | Additiva Impact |
| 55 WD 47 | 10 | 13 | O&G | NA<br>3 | 1<br>1 | NA<br>2 | NA<br>1 | 3<br>2 | 1<br>NA | 3<br>3 | NA<br>3 | NA<br>3 | 8<br>18 | 0.67<br>0.75 | 1.42 |
| 56 SP 57 | 4 | 55 | O | NA<br>3 | 1<br>1 | NA<br>1 | NA<br>1 | 1<br>1 | 3<br>NA | 3<br>3 | NA<br>3 | NA<br>3 | 8<br>16 | 0.67<br>0.67 | 1.34 |
| 57 MP 72,74 | 5 | 36 | O | NA<br>3 | 1<br>1 | NA<br>1 | NA<br>1 | 3<br>1 | 3<br>NA | 3<br>3 | NA<br>3 | NA<br>3 | 10<br>16 | 0.83<br>0.67 | 1.50 |
| 58 MP 114 | 11 | 16 | G | NA | 1 | NA | NA | 3 | 3<br>NA | 2 | NA | NA | 9 | 0.75 | 0.75 |
| 59 MP 116 | 11 | 15 | G | NA | 1 | NA | NA | 3 | 3<br>NA | 2 | NA | NA | 9 | 0.75 | 0.75 |
| 60 MSE 160 | 21 | 37 | G | NA | 1 | NA | NA | 2 | 2<br>NA | 1 | NA | NA | 6 | 0.50 | 0.50 |

| TRACT DATA | | | | RESOURCES AND ACTIVITIES | | | | | | | | | IMPACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tract Number Lease Block Location | Distance from Shore (miles) | Approximate Depth (meters) | Eatimated Type of Production | Littoral Systems | Reefal Systems | Benthic Systems | Endangered Species | Sport and Commercial Fishing | Shipping | Aesthetics | Outdoor Recreation | Cultural Resources | Cumulative Impact | Impact Index | Additive Impact |
| 61 MS2 N658 Z 47 | 31 | 200 | G | NA | 3 | NA | NA | 1 | 1 | 1 | NA | NA | 6 | 0.50 | 0.50 |
| | | | | NA | | NA | NA | | | | NA | NA | | | |
| | | | | NA | | NA | NA | | | | NA | NA | | | |
| | | | | NA | | NA | NA | | | | NA | NA | | | |
| | | | | NA | | NA | NA | | | | NA | NA | | | |
| | | | | NA | | NA | NA | | | | NA | NA | | | |

## Cumulative Impact of the Proposed Sale and Other Federal Actions

### An Additional Gulf of Mexico OCS Oil and Gas Lease Sale

The proposed action is a part of a program to accelerate oil and gas leasing on the Outer Continental Shelf. The proposed OCS Planning Schedule, released in June 1975 (Figure F-1), lists an additional OCS sale in the Gulf of Mexico (Proposed Sale No. 47). The effect of another sale in addition to this proposed sale would be to increase oil and gas operation activity, increase peak activity levels, and generally extend the peak activity period and the timeframe anticipated for this proposed sale. The number and amount of certain activities or substances introduced into the environment as a result of oil and gas activities would be additive in nature, such as number of platforms, drill cuttings disposed, and drilling muds released into the marine environment. Possibilities of oil spills resulting from blowouts would increase since blowout probabilities are a function of the number of wells.

During the past years, several oil and gas lease sales have been held in the Gulf of Mexico and production from these sales represents a significant portion of the Nation's current oil and gas production. The effect of this proposed sale is seen as a continuation of the existing oil and gas production in the Gulf of Mexico region, and the possible continued use of existing facilities established in response to production developed from past onshore and offshore activities. Through January 1, 1975, approximately 15,500 wells had been drilled offshore in the Gulf of Mexico, including 3,997 exploratory wells and 11,503 development wells (API, Basic Petroleum Data Book, 1975).

Since economies of scale could be achieved in some areas, certain activities would not increase in number or amount proportional to the increase in acreage leased or minerals extracted. Onshore support bases and pipelines, depending on the timing and success of additional operations, might require only marginal augmentation.

Two different types of impact associated with the varying levels of activity would result from an additional Gulf of Mexico sale. Some impacts would be additive in nature, such as the amount of acreage devoted to platform use. Other impacts would be expected in the nature of maintenance of an existing level of activity. For example, the types and magnitude of economic activity expected to result from this proposed sale are not believed to be great enough to stimulate substantial increases in population and economic activity in some shore counties in which primary support facilities might be located. An additional sale and higher levels of production may stimulate enough activity in some sectors of the economy to result in more sustained levels of population and economic activity in localized areas. An additional basis for industrial location decisions would be provided by additional quantities of oil and gas adding to the possibility of greater and/or sustained economic activity.

It is more difficult to anticipate possible cumulative impacts to marine organisms. An extreme example of cumulative impacts to biological systems would be in a case in which threshold levels were reached by one action. For example, if the amount of chronic oil pollution or other effects of activities resulting from a single sale (possibly in combination with other factors) were enough to reduce a population to a critical level, then any incremental activity could be expected to result in the destruction of that population. However, understanding of the complex relationships of the various living and nonliving components of the marine environment and the effects of OCS oil and gas development on them are not, in general, sufficient to allow identification of the cumulative impact of additional sales. Even on a sale-specific basis, the identification, and especially the quantification of these impacts cannot be made with absoute certainty.

The cumulative impact of OCS lease sales in other regions has been addressed in the Final Environmental Impact Statement on the Proposed Increase in Acreage to be Offered for Oil and Gas Leasing on the Outer Continental Shelf, released by the Bureau of Land Management in July 1975.

### Deepwater Ports

Deepwater port proposals have been put forth for the Gulf of Mexico including one off the coast of Louisiana and another off the coast of Texas. The Department of Transportation, the responsible Federal agency, receives permit applications for deepwater ports.

The extent to which effects of a deepwater port operating concurrently with OCS oil and gas leasing activities would be cumulative in nature would depend in part on whether such a port is built to accommodate existing crude imports. To a larger extent, the provision of expanded refining capacity and associated deepwater ports would be a function of demand, market location, and transportation economics. If deepwater ports in the Gulf of Mexico result in a higher volume of crude transported and a higher volume of associated spills, then cumulative oil-related impacts to marine and coastal organisms could be expected. The extent and nature of these impacts would depend on the location of the port(s), any new refineries, and OCS-related facilities.

It has been suggested that oil and/or gas from the OCS might be transported to shore through the same pipeline(s) serving a deepwater port. There is no provision for this in existing legislation, and as yet it is unclear whether this would be possible. Existing legislation is administered by the Department of Transportation.

More information regarding the impacts of deepwater ports may be found in the Department of the Interior's Environmental Impact Statement on Deepwater Ports issued June 1973.

### Ocean Dumping

The use of designated or interim ocean dumpsites will continue through the beginning of the next decade at which time EPA plans to phase out this practice. Given the anticipated level and timing of OCS related operations, ocean dumping would be occurring during the exploration and development phase(s). Cumulative impacts would result from pollution loadings and increased marine traffic. Increased numbers of vessels passing through dumping grounds could result in increased vessel-vessel accidents though the chances for oil spills are remote. The amount of drill cuttings, accidentally released drilling muds, and resuspended sediments caused by potential pipeline emplacement would be additive to the amounts of material disposed of by ocean dumping, and would add to the total sediment load in the ocean. Of this total, only a small fraction of the drilling mud introduced into the marine environment, or possibly the polluted, resuspended sediments (from pipeline burial) could have a cumulative negative impact on marine organisms when added to the loadings caused by ocean dumping.

Additional consideration of specific factors has been included in this Impact Statement in the section entitled, ''Environmental Impacts of the Proposed Action.''

# MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION

The following discussion concerns the mitigatory measures which will reduce possible adverse impacts that could result from this proposed sale. These measures are presented as they relate to oil spills, offshore structures and pipelines as well as other impact-producing activities associated with OCS oil and gas development.

## Oil Spills

### Regulations—OCS Orders

Regulations governing OCS mineral operations in the Gulf of Mexico are contained in Title 30, Code of Federal Regulations and OCS Orders Nos. 1, 3, 4, 6, 7, 10 effective August 28, 1969; No. 2 effective January 1, 1975; No. 5, effective June 5, 1972; Nos. 8-9, effective February 1, 1975; and No. 13 effective October 1, 1975 (Appendix B). Leasing regulations are contained in Title 43, Code of Federal Regulations. The regulations established procedures and requirements to be followed in all stages of lease operations: exploration and development, drilling, production, transportation (pipeline construction and operation) and abandonment.

Regulations governing the safe conduct of mineral operations and development of the OCS are administered by the U.S. Geological Survey. Appendix B contains the full text of the Gulf of Mexico OCS Orders. Additional OCS Orders may be prepared and issued and the existing Orders revised as the need occurs throughout OCS operations. In the case of violations, leases are subject to cancellation and leases are subject to the penalty of the OCS Lands Act.

A general description of operating requirements under the Gulf of Mexico OCS Orders follows.

#### GULF OF MEXICO OCS ORDER NO. 1

This Order requires all platforms, drilling rigs, drilling ships and wells to have signs of standard specifications for identification of the operator, the specific lease block of operation, and well number. It also requires the marking of all subsea objects which might present a hazard to other areas of the OCS.

This Order states that all subsea objects resulting from lease operations which could present such a hazard must be identified by navigational markings, of a design approved by the Supervisor and not inconsistent with applicable U.S. Coast Guard Regulations. Under this provision, the potential for accidents to subsea production systems, "stubs," fishing gear, and ship anchors is substantially reduced as is the possibility of an oil spill from such an accident. This effectively eliminates some of the impacts which were discussed in Section III.

#### GULF OF MEXICO OCS ORDER NO. 2

Order No. 2 concerns procedures in drilling of wells. It requires the operators to file an application for drilling which includes information on the drilling platform or vessel, casing program, mud program, blowout prevention equipment, well control training and safety training of operators' personnel, and a list or description of critical drilling operations which are or may be performed. The Order then describes certain procedures or equipment to be used in each phase of the drilling operation.

All wells must be cased and cemented in order to support unconsolidated sediments, prevent leakage of fluids between formations or pressure changes in the well. If there are indications of improper cementing, the well must be recemented and logs run to indicate proper sealing of the well hole walls. The casing design and setting depths are to be based on all engineering and geological factors including the presence or absence of hydrocarbons, abnormal pressure, potential hazards, and water depths. A pressure test is required of all casing strings, except the drive or structural casing, to determine the presence of leaks or inadequate cementing. The use of casing as described in this Order should eliminate potential impacts of fresh water zone contamination, lost production, or the possibility of accidents caused by improper casing.

Blowout preventers and related well control equipment must be installed, used and tested in a manner necessary to prevent blowouts. A specific number of these preventers must be used in every well and they must include a fail-safe design; dual control systems, and fail-safe valving on critical lines and outlets.

The charateristics, use, and testing of drilling mud, and the conduct of related drilling procedures shall be such as to prevent the blowout of any well. Sufficient quantities of mud are to be maintained and readily accessible for use at all times to insure proper well control. This part of Order No. 2 provides additional protection against possible blowouts (Section III.A.5.).

Representatives of the operator will provide on-the-site supervision of drilling operations on a 24-hour basis. A member of the drilling crew or the toolpusher will maintain surveillance of the rig floor continuously from the time drilling operations commence until the well is either completed or abandoned. All supervisory personnel including drillers must be trained in present day methods of well control, and records of the training are to kept at the well site. Weekly blowout preventlion drill exercises are required of all rig personnel. These requirements will also substantially reduce the possibility of blowout or other rig accidents (Section III.A.5.), and provide additional safety margins for all crew members.

Procedures to be followed when drilling operations are undertaken to penetrate reservoirs known or expected to contain hydrogen sulfide gas are now included in U.S. Geological Survey OCS Standard No. 1 (GSS-OCS-1), ''Safety Reguirements for Drilling Operations in a Hydrogen Sulfide Environment.'' This set of standard operating procedures will assure the proper testing and safety of the crew as well as the drilling platform or vessels should $H_2S$ be encountered. Hazards of $H_2S$ are substantially reduced by the institution of these procedures.

### GULF OF MEXICO OCS ORDER NO. 3

This Order is established to provide regulation of plugging and abandonment of wells which have been drilled for oil and gas.

For permanent abandonment of wells, cement plugs shall be spaced to extend 30 m (100 ft.) above the top and 30 m below the bottom of fresh water, oil, and gas zones to prevent those fluids from escaping into other strata. Portions of a well in which abnormal pressures are encountered are also required to be isolated with cement plugs. Plugs are required at the bottom of the deepest casing where an uncased hole exists below. Plugs or cement retainers are required to be placed 30 m above the top and 30 m below any perforation interval of the well hole used for production of oil and gas. A ''surface'' plug 46 m (150 ft.) long shall be placed in the smallest string of casing which extends to the surface. A pressure test must be made of the top plug below the surface plug, spaces between plugs must be filled with drilling muds of sufficient density to exert hydrostatic pressure exceeding the greatest formation pressure encountered in drilling each interval. The casing and piling on the sea floor removed to at least 5 m (15 ft.) a depth below the sea floor. For temporary abandonments, plugs and mud must be emplaced with the exception of a surface plug. (The temporary abandoned well would have to be marked in accordance with Order No. 1.)

### GULF OF MEXICO OCS ORDER NO. 4

Order No. 4 provides for extension of a lease beyond its primary term for as long as oil or gas may be produced.

If these circumstances should occur, a lease can be extended beyond its initial term, pursuant to Section 8(b)(2) of the OCS Lands Act and Title 30 CFR 250.12 (d)(1).

A production test of at least two hours duration following stabilization is required for both oil and gas wells. All pertinent engineering, geologic, and economic data is required to support a claim that a well is capable of being produced in commercial quantities. Each test must be witnessed by an authorized representative of the U.S. Geological Survey, although under certain circumstances, an operator's affidavit or a third party test may be acceptable. The purpose of this Order is to guarantee that a lease has been found to be capable of producing oil or gas prior to granting an extension on the lease.

### GULF OF MEXICO OCS ORDER NO. 5

This Order sets regulations for the installation, design, testing, operation, and removal of subsurface safety devices. The Order requires that all well tubing installations open to hydrocarbon-bearing zones shall be equipped with a subsurface controlled or a surface controlled subsurface safety device that is placed 30 m or more below the sea floor. All wells perforated and completed but not placed on production must be equipped with a subsurface safety device or tubing plug within two days after the well is completed. Subsurface safety devices should also be placed in injection wells unless they are incapable of flowing oil and gas. All safety devices must comply with the minimum standards set forth in the ''API Spec. 14A, First Edition, October 1973, Subsurface Safety Valves'' and recent supplements as approved by the Area Supervisor. Testing of the device must take place monthly for six months after installation and quarterly thereafter; if it does not operate correctly, it must be promptly removed with a properly operating device put in place and tested. Additional protective equipment is also required with the use of subsurface protective devices. In a case where tubing installations have been opened to hydrocarbon zones and are not equipped with subsurface safety devices (during workover), the installation must be so identified and such a device or tubing plug must be available at the field location to be emplaced if necessary. Records must be kept of all subsurface safety devices employed at each well with quarterly reports prepared on reasons for any failures of the devices.

This Order provides additional means to prevent blowouts and keep wells under control, thereby reducing risks described in Section III.

### GULF OF MEXICO OCS ORDER NO. 6

OCS Order No. 6 is under revision, and has been published in the Federal Register, Vol. 41, No. 114—Friday, June 11, 1976, soliciting comments from interested parties.

### GULF OF MEXICO OCS ORDER NO. 7

Order No. 7 sets forth a means to effectively deal with pollution of the marine environment from offshore petroleum operations. It states that the operator must prevent pollution of the ocean and that the disposal of waste products must not create conditions that can "adversely affect the public health, life or property, aquatic life or wildlife, recreation, navigation or other uses of the ocean". The proposed revision of OCS Order No. 7, Gulf of Mexico Area, considers requirements for pollution prevention and waste disposal. This Order states that the operator shall submit with the Application for Permit to Drill (Form 9-331C) a detailed list of drilling mud constituents and their concentrations, including the chemical composition of trade name components, and a list of the drilling mud additives anticipated for use in meeting special drilling requirements. Drilling mud containing toxic substances shall be neutralized prior to disposal. The consensus of the operator comments was that data of this type is not routinely available to them and would violate the proprietary property rights of the mud supplier. Also, this is impractical because ranges of materials that are used vary widely dependent upon the individual drilling conditions.

Numerous comments were received regarding pollution reporting and requirements. Comments with reference to pollution reporting would have the Order make no distinction as to the quantity of oil spilled since spills of all types require immediate reporting. The comments concerning the requirements of pollution control cleanup equipment would change the frequency of inspections of this equipment and the specific time of development for this equipment.

Comments were also made that would allow approvals be given from the District Supervisor instead of the Area Supervisor for expediency in obtaining remedies for produced waste water problems and also pollution cleanup.

The remaining comments from the operators would have the wording of the Order reflect the wording of EPA regulations and Title 40 CFR 435. There were also other comments regarding word changes which could be made for clarity.

No cuttings, sand or other solids containing free oil are to be disposed of into the ocean unless the oil is removed, thus eliminating potential impacts to water quality and marine organisms caused by such introduction of oil to the marine environment.

All personnel must be thoroughly instructed in the prevention of pollution from offshore operations. Rigorous inspection schedules are required for all facilities. Pollution reports are necessary for all oil spills with notification of proper authorities. Standby pollution control equipment must be maintained or available to each operator. The equipment must include booms, skimmers, cleanup materials, and chemical agents (though chemical agents can only be used with the express consent of the Supervisor). Results of inspections of this equipment must be recorded. Any application for a drilling permit must include an oil spill contingency plan with provisions for varying degrees of response effort depending on severity of oil spill; identification of containment and cleanup equipment availability; notification procedures of responsible persons and alternatives in the eventuality of a spill; and provision for specific actions to be taken after discovery and notification of an oil discharge. Should a spill; and provision for specific actions to be taken after discovery and notification of an oil discharge. Should a spill occur, immediate corrective action must be taken.

### GULF OF MEXICO OCS ORDER NO. 8

Proposed OSC Order No. 8 prescribes approval procedures for the design, installation and operation of fixed platforms and structures to be used for offshore oil and gas production operations.

Safety equipment and pollution control equipment requirements are also set forth.

Some commentors suggested that the requirement for complying with API RP 14C pertinent to new platforms within three months should be extended to six months after the effective date of the Order.

Several comments indicated that the requirement to shut in all producible wells while welding or burning in the wellhead area would cause undue shut in time and loss of production. It was proposed by the commentors that a specific plan for such welding and burning operations while producing be submitted to the District Supervisor for approval.

A comment was received which suggested that the specifications of API Spec 14D be followed pertaining to allowable leakage rates through surface safety devices.

A recommendation was received that the requirements of paragraphs 2.C.(2) and 2.C.(3) of the Order be deleted (Foundation loads).

One commentor suggested deletion of paragraph 4.C. which requires the operator to submit information relative to the design and installation of production facilities. In order for the USGS to effectively perform its assigned regulatory function this information is necessary for appraisal, approval and subsequent lease inspection activities.

It was suggested that paragraph 4.D.(3)(d) be deleted or modified to allow the testing of liquid-level controls by manual activation of the float and float arm.

One commentor questioned the adequacy of the design specifications of API RP 2A for steel structures in very deep water, and suggested that such structures be evaluated on an individual basis. API RP 2A is essentially a "recommended practice" and suggests that all designers "utilize all research advances available to them," and all structures are evaluated on an individual basis.

One commentor suggested that the requirement for installing a hydrocarbon separator in the glycol return line to the glycol dehydration unit would serve no purpose in regard to safety or pollution prevention since hydrocarbon separators are of a design and operational consideration.

It was suggested that, in regards to the provisions of paragraph 4.D(1)(a)(ii), since numerous older pressure vessels are equipped with rupture discs and that therefore the relief capacity of the vessel relief valves are sized for less than full vessel capacity, compliance with the Order would require additional piping and/or vessel modification. The intent of the Order is to require the design and installation of relief valves so as to carry off the maximum quantity of fluids and gases that can be generated or supplied to the vessel (according to the ASME Code, Section VIII, VG-132, p. 65). In addition, rupture discs cannot be tested and when rupture discs burst as designed the entire volume of gases or fluids are relieved. This is considered to be detrimental to safety and a source of pollution.

Many other comments were received which related to changes in language which would clarify the intent of the Order. These portions of the Order were written or rephrased to afford the necessary clarification.

### GULF OF MEXICO OCS ORDER NO. 9

Order No. 9 provides approval procedures for oil and gas pipelines. This includes the purpose of each line, proposed route, water depths, capacity, operating pressures, size and grade of pipe, burial depth, corrosion protection, protective coating, connecting and metering facilities, and pressure control facilities. The methods of welding and laying the pipeline are to be monitored, as is the installation of connecting facilities. A hydrostatic test to greater than the design working pressure of the line will be made upon completion of installation.

The effect of this Order is to greatly reduce the chance for offshore oil spills or gas leaks as discussed in Section III. The approval of pipeline routes by the USGS as well as BLM and the Department of Transportation (described elsewhere) can effectively reduce a variety of impacts to marine biota and multiple uses of the Gulf of Mexico OCS.

### GULF OF MEXICO OCS ORDER NO. 10

Order No. 10 establishes sulphur drilling procedures. The orders are basically the same as OCS Order No. 2 except for a few variations.

The distance that the conductor casing is installed is not to exceed a depth of less than 107 m (350 ft) nor more than 229 m (750 ft) below the Gulf floor.

The caprock casing shall be set at the top of the caprock and be cemented with a quantity of cement to fill the annular space back to the Gulf floor.

A bag-type blow-out preventer shall be tested to 70% of the noted working pressure of the stack assembly. It shall be actuated on the drill pipe once each week. Accumulators and accumulator pumps shall maintain a pressure capacity reserve at all times to provide for repeated operation of hydraulic preventors.

### GULF OF MEXICO OCS ORDER NO. 11

This Order provides for the prevention of waste, conservation of oil and gas, and protection of correlative rights. Enhanced recovery of all oil and gas from a lease is required and production rates of oil and gas are established. Each operator shall produce without waste his proper share of oil and gas from a common source of supply. Production procedures to be followed in the eventuality of shut-ins for overproduction or storms are set forth as are requirements for all tests of well productivity. Requirements concerning the location of all wells are given as are the ability of the Supervisor to decide issues on field unitization.

Therefore, this Order provides a means to insure proper production of oil and gas and placement of facilities to maximize production while minimizing environmental impact. This provides control on impacts described in Section III.

### GULF OF MEXICO OCS ORDER NO. 12

This proposed Order sets forth requirements for public availability of data and records concerning offshore petroleum operations. Exclusion of geological and geophysical interpretations, maps, and data required to be submitted is not available for public inspection. Certain records pertaining to leases and wells are made available for public inspection such as: Monthly Report of Operations; Well Completion or Recompletion Reports and Log; Sundry Notices and Reports on Wells; Application for Permit to Drill, Deepen or Plug Back; Quarterly Well Test Reports; Semiannual Gas Well Test Reports; Multi-point Back Pressure Test Report; Sales of Lease Production; and Inspection Records.

### GULF OF MEXICO OCS ORDER NO. 13

Order No. 13 requires the accurate measurement of oil and gas production and set forth stipulations under which production from several wells can be commingled. This Order will offset any possible attempts of fraud and alleviate public concerns that operators are underestimating royalties due the Federal government.

### PROPOSED GULF OF MEXICO OCS ORDER NO. 14

Order No. 14 will assure diligence in the development of OCS natural resources by allowing limited suspensions of operations or production while the operator is waiting for installation of equipment or granting of permits necessary for transportation of oil and gas from a lease. Criteria will be set under which suspensions can be granted and will provide a means to determine if production is being withheld for purposes other than as stated.

### PROPOSED GULF OF MEXICO OCS ORDER NO. 15

Order No. 15 on the submittal of information for development plans, pursuant to the new requirements established in 30 CFR 250.34 in November 1975, will detail the required data contents and the review process to be followed before the Supervisor grants approval of the development plan(s) of each lessee. The lessee will submit the information to the directly affected states concerning information on the proposed onshore and offshore facilities anticipated for development. This information may be submitted simultaneously to the States with the formal development plan(s).

There is presently a Task Force consisting of Department of the Interior personnel and representatives from each of the five regions of the OCS Advisory Board, which is working on more detailed guidelines for this Order.

### INSPECTION PROGRAMS AND APPROVAL REQUIREMENTS

To enforce the Geological Survey Operating Regulations (30 CFR 250) and OCS Orders, a comprehensive inspection system has been developed. OCS operators must receive approval before commencing any work. Operators are required to submit a notice and detailed description of work they desire to perform to the USGS District Supervisor. This requirement is to insure that no operation is conducted without thorough planning for safety, conservation, and protection of the environment, and to determine that all operations meet the standards established by regulations and OCS Orders.

### ON-SITE INSPECTION

All operations, regardless of the activity, will receive regular on-site inspection for compliance with regulations and OCS Orders. The Geological Survey uses a systematic program including both scheduled and unannounced inspections to assure the achievement of safety objectives. Floating drilling vessels or drilling units will receive a detailed inspection to insure conformance with regulations and OCS Orders before commencement of drilling operations. These predrilling inspections are comprehensive and often require several days to complete. Also, these rigs will be inspected at least once during the drilling of a well, and all well control, safety, and pollution control equipment will be inspected for proper function.

Permission to either abandon or suspend a well must be granted by the USGS; this includes the setting of all required cement plugs, the cutting of the several casing strings below the sea floor, and the removal of all subsea equipment. The depth below the sea floor at which the casing is removed will be reviewed by the USGS on a case-by-case basis to ensure that sediment migration will not eventually expose the casing stub.

Well workover and well abandonment phases of OCS operations, as with drilling, will receive both scheduled and unscheduled inspections, depending on the progress of a particular operation. Drill stem testing, cement plugs set prior to redrilling a well, cement plugs set to temporarily or permanently abandon a well, and all casing cementing operations must be approved by the USGS Supervisor.

OCS pipelines will be installed in accordance with the Gulf of Mexico OCS Order No. 9, which will provide for submittal of information such as purpose of each line, proposed route, water depths, capacity, operating pressures, size and grade of pipe, burial depth, corrosion protection, protective coating, connecting and metering facilities, and pressure control facilities. The methods of welding and laying the pipeline are monitored, as in the installation of connecting facilities. A hydrostatic test to greater than the designed working pressure of the line is made upon completion of installation.

### INSPECTION SCHEDULE AND ENFORCEMENT

The inspection program for the Gulf of Mexico OCS area is maintained by the U.S. Geological Survey with the intent that required regulations will be followed to avoid potential hazards to personnel, provide protection for the environment, and preserve the multiple-use concept of the OCS lands. Warnings for incidents of noncompliance are issued and the date of correction of defects are recorded.

Visual inspections of the water surface over OCS pipelines in the Gulf of Mexico operating area are currently made by the operator for evidence of failures and leaks. USGS and operator personnel in this area visit production facilities daily and follow a route approximating the pipeline route.

The U.S. Coast Guard also patrols for oil spills or leaks with vessels and aircraft.

An approved contingency plan is required from each operator in the Gulf of Mexico that includes spill control, containment and cleanup, and measures to be taken if there is any likelihood that hydrogen sulfide gas might be encountered during the drilling operation.

### INSPECTION PROCEDURES FOR SUBSEA SYSTEMS

Subsea systems may possibly be used to produce oil and gas resulting from this proposed sale. Inspections of these systems in the Gulf of Mexico will be in accordance with the OCS Orders. Order No. 1 requires the surface marking of all such systems in accordance with guidelines developed by the USGS Supervisor.

The many Federal agencies involved in the review process of subsea systems include in addition to the Geological Survey: EPA, Coast Guard, Corps of Engineers, U.S. Fish and Wildlife Service, and the Bureau of Land Management. Except for proprietary parts, plans for exploration and development utilization are available for general public review.

### OPERATOR REPORTS

A comprehensive reporting system covering all oil spills and any unusual conditions (for example, reporting and investigation of a persistent oil slick from an unknown source, such as a sunken ship or natural oil seep) is required by the OCS Orders, and is a key factor in monitoring operations in the Gulf of Mexico. Operators are also required to maintain records for inspection by the Geological Survey of required periodic tests of safety equipment. A digest of these operator reports and the various forms that are required can be found in the Gulf of Mexico OCS Order No. 12, Appendix B.

### Enforcement

The USGS policy is intended to eliminate any noncompliance with lease requirements by the operator that may lead to loss of life, loss of property and resources, or damage to the environment. A standardized compilation of items has been prepared by the USGS, entitled "List of Potential Items of Noncompliance and Enforcement Action," the "PINC" list, which is used for inspection. During an inspection of drilling and production operations, depending on the hazard presented toward safety or pollution, either a written warning will be given that allows the operator seven days to correct the incident of noncompliance (INC), or a shut-in order will be issued. The shut-in order may be applied only to the equipment affected by the incident of noncompliance such as a particular piece of production equipment of a producing zone, or to the entire drilling rig, production platform, or onshore facility, as required.

Additional penalties for noncompliance are specified in Section 5(a)(2) of the Outer Continental Shelf Lands Act of 1953, 43 U.S.C. Sec. 1334(a)(2).

> Any person who knowingly and wilfully violates any rule or regulation prescribed by the Secretary for the prevention of waste, the conservation of natural resources, or the protection of correlative rights shall be deemed guilty of a misdemeanor and punishment by a fine of not more than $2,000 or by imprisonment, and each day of the violation shall be deemed a separate offense.

Also, Sections 5(b) and 5(b)(2) provide for cancellation by notice of nonproducing leases subject to judicial review or appropriate judicial proceedings.

The total number of warnings issued and suspensions ordered for infractions of OCS Orders which occurred during normal daily inspections from December 1, 1972 through January 31, 1976 are as follows:

| | |
|---|---|
| Warnings: | |
| Drilling | 74 |
| Workover | 17 |
| Production | 5,647 |
| Suspensions: | |
| Drilling | 50 |
| Workover | 6 |
| Production | 4,126 |

During the period of July 1, 1975 through January 31, 1976 there were four significant oil spills of more than 15 barrels reported which are described below:

While a drilling rig was taking on diesel fuel from a supply boat the rig fuel tank overflowed through the vent line spilling 20 barrels. The control room operator on loading fuel had not been attentive enough to his gauges.

The Anchor Ship was pulling an anchor in close to the Drillship. Rough seas caused the anchor to knock a hole in the Drillship fuel tank spilling 100 barrels.

Vibration caused a gasket to blow out of a flange on the discharge side of an oil transfer pump. Twenty (20) barrels of oil were spilled.

Lightning struck a production platform during an electrical storm causing a shut-in of all wells. The safety valve on one well failed to completely shut off flow and 15 barrels were spilled.

In accord with prescribed inspection procedures, Geological Survey personnel verified that remedial action had been taken in all of the above incidents prior to the reactivation of the production facilities.

A program of intensive inspections is used on OCS leasing. Inspections are conducted on a regular basis with emphasis placed on operations. Periodically, all available inspectors devote a week to a special inspection, where production platforms and drilling wells are inspected on a random basis. The Geological Survey inspector force in the Gulf of Mexico has increased from seven technicians and five engineers as of July 1, 1969, to 42 technicians and 17 engineers as of January 31, 1976. During the period November 1, 1972 through January 31, 1976 technicians spent 15,130 inspection days or 133,025 man-hours, and engineers 1,546 inspection days or 13,556 man-hours in the field. Detailed inspections were conducted on 4,444 major producing platforms and 3,063 minor platforms in the Gulf of Mexico from December 1, 1972 through January 31, 1976. Also, during this time period, 2,598 inspections of single-wells or satellites were made by boat, approximately 60% of these inspections were unannounced. Included in these inspections were 48,105 well completions. Also, during this time period, 5,071 inspections of drilling rigs were conducted. Data are not readily available on the significance of these data per reporting period. However, it is apparent that inspections have increased considerably per period since 1972.

Minor incidents of non-compliance result in formal warnings while incidents of non-compliance of a potentially more hazardous nature result in well or platform shut-ins until the operation is in full compliance with regulations and orders.

Tables A-1, A-2 and A-3 indicate equipment malfunctions detected during inspection and enforcement actions over three separate periods. These data include only the results of special inspections and are limited to the most frequent malfunctions detected.

These tables indicate specific items found to be in non-compliance during special inspections. Basic pollution control items or production equipment in which malfunctions were detected for the time period are identified. Listed in the third column are the number of items which did not operate within acceptable tolerances. These items did not fail or cause an undesirable event.

Velocity type subsurface safety valves are periodically pulled from the wells and checked. This requires removing the valve from the well for inspection, repair, adjustment, and reinstallations. One company utilized test stands to test the valve performance characteristics under simulated flow and pressure conditions. Surface operated subsurface safety valves are tested in place by releasing hydraulic pressure within the closed system thereby closing the valve; subsequently, the valve is reopened by repressuring the system. An average reporting period from February through April 1975 resulted in approximately 3,000 subsurface safety valves being checked. Of this amount, 174 failed components were detected in the valves, with a number of the valves having more than one failed component.

Nine companies were fined a total of $2,358,000 in District Court for failure to install subsurface safety devices in offshore oil wells during 1970 in the Gulf of Mexico.

Experienced private and government personnel are aware that public attention was focused on the oil spill at Santa Barbara in January 1969, and probably because of this awareness, there has been a great deal less oil pollution in the Gulf as a result of normal oil and gas producing operations. Table A-4 summarizes the oil spills in the Gulf since 1972.

In the past, major events were cataloged while less serious events were often not reported. Some years ago, wells were on occasion intentionally flowed into the water for short periods during clean-up operations. Now, sophisticated burning devices are designed to consume this well clean-up oil without producing air or water pollution. Automatic equipment is now in use which shut-in production whenever a leak occurs in pipeline or production facilities. These include, but are not limited to, pressure sensors and high and low level controls. Drip pans are placed under valves, vessels and the production system in order to prevent leaking oil from escaping into the waters of the Gulf.

During the past four years, the average number of pipeline malfunctions which resulted in oil spillage was approximately twenty per year, with thirty occurring during 1974. This apparent increase may be attributed to: increased inspections and better reporting; increased footage of pipelines; age of existing pipelines; and damage by tropical storms (personal communication, USGS, 1975).

From January 1, 1971 through October 31, 1975 there were approximately 49,111 barrels of oil produced per barrel of oil spilled.

### Contingency Action

Oil spills will occasionally occur as a result of natural disasters, equipment failure or human error. In the event that such an emergency occurs, the following action will be taken:

#### REQUIREMENTS OF OCS ORDER NO. 7

In the case of any spill, the operator is required to initiate action to control and remove the oil pollution in accordance with his approved emergency plan. In any case, a spill or leakage of less than 15 bbls. requires a report from the operator as to the nature of the spill or leakage, the reason for its occurrence and what steps were taken to correct it. A spill of 15-50 bbls. must be reported immediately to USGS by telephone and confirmed in writing. A spill of over 50 bbls. or one of any magnitude that cannot be immediately controlled must be reported immediately to the Coast Guard, the Environmental Protection Agency and the Geological Survey.

#### REGIONAL OR NATIONAL CONTINGENCY PLANS

If the operator should be unable to control and remove the pollution, the Regional or National Oil and Hazardous Substances Pollution Contingency Plan may be activated and the designated Federal On-Scene Coordinator would direct control and clean-up operations at the operator's expense. This has never been necessary to date in the case of any spill from OCS operations.

TABLE A-1.—*Equipment malfunction detected January through November 1972 special inspections*

| | No. checked | Operable | Inoperable or not within acceptable tolerances | Percent failure |
|---|---|---|---|---|
| Surface safety valves | 1,533 | 1,480 | 53 | 3.5 |
| Flowline sensors | 3,021 | 2,982 | 39 | 1.3 |
| Check valves | 1,434 | 1,370 | 64 | 4.5 |
| Pressure vessels: | | | | |
| High pressure sensors | 961 | 942 | 19 | 2.0 |
| Low pressure sensors | 610 | 600 | 10 | 1.6 |
| High level shut-in | 351 | 345 | 6 | 1.7 |
| Low level shut-in | 323 | 314 | 9 | 2.8 |
| Total | 8,233 | 8,033 | 200 | 2.4 |

TABLE A-2.—*Equipment malfunctions detected January through November 1973 special inspections*

| | No. checked | Operable | Inoperable or not within acceptable tolerances | Percent failure |
|---|---|---|---|---|
| Surface safety valves | 1,492 | 1,423 | 69 | 4.6 |
| Flowline sensors | 1,327 | 1,290 | 37 | 2.8 |
| Check valves | 1,469 | 1,385 | 84 | 5.7 |
| Pressure vessels: | | | | |
| High pressure sensors | 1,100 | 1,077 | 23 | 2.1 |
| Low pressure sensors | 784 | 771 | 13 | 1.7 |
| High level shut-in | 405 | 398 | 7 | 1.7 |
| Low level shut-in | 383 | 375 | 8 | 2.1 |
| Total | 6,960 | 6,719 | 241 | 3.5 |

Source: U.S. Geological Survey, 1975.

TABLE A-3.—*Equipment malfunctions detected January 1974 through July 1975 equals special inspections*

| | No. checked | Operable | Inoperable or not within acceptable tolerances | Percent failure |
|---|---|---|---|---|
| Surface safety valves | 1,237 | 1,187 | 50 | 4.0 |
| Flowline sensors | 3,557 | 3,521 | 36 | 1.0 |
| Check valves | 1,420 | 1,324 | 96 | 6.8 |
| Pressure vessels: | | | | |
| High pressure sensors | 456 | 450 | 6 | 1.3 |
| Low pressure sensors | 237 | 234 | 3 | 1.3 |
| High level shut-in | 332 | 322 | 10 | 3.0 |
| Low level shut-in | 418 | 389 | 29 | 6.9 |
| Total | 12,858 | 12,460 | 398 | 3.1 |

TABLE A-4.—*Summary of oil slicks and oil spills information related to oil spills which occurred from July 1, 1975 through January 31, 1976 is summarized below*

| Month | No. spills | Vol. crude (barrels) | Vol. other | No. spills one barrel or less | No. slicks sighted |
|---|---|---|---|---|---|
| July | 11 | 39 | | 109 | 60 |
| August | 9 | 47 | 3 oil base mud | 101 | 51 |
| September | 11 | 32 | 100 diesel | 105 | 55 |
| October | 8 | 26 | 20 diesel | 66 | 56 |
| November | 7 | 31 | 2 methanol | 66 | 24 |
| December | 6 | 17 | | 66 | 36 |
| January | 5 | 15 | 2 diesel | 71 | 35 |
| Total | 57 | 207 | 124 diesel<br>3 oil base mud<br>2 methanol | 584 | 317 |
| Total since November 1972 | 438 | 45,712 | 62 Condensate<br>631 Diesel<br>47 Oil base mud<br>3 Distillate<br>10 Corrosion inhibitor<br>2 Methanol | 1,710 | 1,902 |

Source: Geological Survey, Metairie, Louisiana (March 10, 1976)

The Regional or National Oil and Hazardous Substances Pollution Contingency Plan was developed pursuant to the provisions of the Federal Water Pollution Control Act as amended (33 U.S.C. 1101). EPA has published the revised National Oil and Hazardous Substance Pollution Contingency Plan as required by the Federal Water Pollution Control Act Amendments of 1972. Section 11(c)(2) of that statute authorized the President, within sixty days after the sections become effective, to prepare and publish such a Plan. The Plan provides for efficient, coordinated and effective action to minimize damage from oil (and other) discharges, including containment, dispersal and removal. The Plan includes: assignment of duties and responsibilities; identification, procurement, maintenance and storage of equipment and supplies; establishment of a strike force and emergency task force; a system of surveillance and notice; establishment of a national center to coordinate response operations; procedures and techniques to be employed in identifying, containing, dispersing and removing oil; and a schedule identifying dispersants and other chemicals that may be used in carrying out the Plan and the waters and quantities which they may be safely used. Annex X of the Plan basically sets forth a no dispersant policy. Exceptions can be made for safety reasons (to prevent fire or explosions) or for certain other circumstances such as the protection of endangered waterfowl. However, the approval of EPA is required, except in cases of safety when the approval of the On-Scene Coordinator is required. The Plan is revised from time to time as necessary. Operation of the National Contingency Plan requires a nationwide network of regional contingency plans. Guidelines for that nationwide network are established in the National plan. This Plan provides for a pattern of coordinated and integrated responses of departments and agencies of the Federal Government to pollution spills. It establishes a national response team and provides guidelines for the establishment of regional contingency plans and response teams. The Plan also promotes the coordination and direction of federal, state and local response systems and encourages the development of local government and private capabilities to handle such pollution spills.

The objectives of the Plan are: to develop appropriate preventive and preparedness measures for discovering and reporting the existence of a pollution spill; to promptly institute measures to restrict further spread of the pollutant; to assure that the public health, welfare and natural resources are provided adequate protection; to provide for the application of techniques for clean-up and disposal of the collected pollutants; to provide for a scientific response to spills as appropriate; to provide strike forces of trained personnel and adequate equipment to polluting spills; to institute actions to recover clean-up cost; and to effect enforcement of existing federal statutes and regulations issued thereunder. Detailed guidance toward the accomplishment of these objectives is contained in the basic Plan, the annexed and the regional plans.

The Plan is effective for all United States navigable waters including inland rivers, the Great Lakes, coastal territorial waters and the contiguous zone and high seas beyond this zone where a threat exists to United States waters, shore-face or shelf-bottom. Its provisions are applicable to all federal agencies.

A memorandum of understanding between the Department of the Interior and the Department of Transportation outlines the respective responsibilities of the Geological Survey and the Coast Guard under the National Contingency Plan. The Geological Survey is responsible for the coordination and direction of measures to abate the source of pollution when the source is an oil, gas or sulphur well. This responsibility includes the authority to determine whether pollution control operations within a 500 meter radius of the pollution source should be suspended to facilitate measures to abate the source of pollution. The Coast Guard is responsible for the coordination and direction of measures to contain and remove pollutants, and shall furnish or provide the On-Scene Coordinator with authority and responsibilities as provided by the National Contingency Plan.

### PETROLEUM INDUSTRY CONTINGENCY PLAN

#### *Inventory of known resources available for emergency oil spill control and clean-up*

From the upper Texas coast to the Mississippi Delta region offshore operators maintain a large inventory of various kinds of equipment that could be put to use on short notice for containing and cleaning up an oil spill and killing the source of the spill. This inventory includes 177 boats ranging from 30 crewboats to 50 meter utility and cargo vessels, 64 helicopters, and 103 fixed-wing aircraft. For a complete inventory of oil spill containment and clean-up equipment see USDI, 1975b, Appendix C.

*Clean Gulf Associates*

Clean Gulf Associates is a non-profit organization formed by thirty-nine companies (these companies produce 98% of offshore petroleum) operating in the OCS. Their purpose is to provide for a stockpile of oil spill containment and clean-up materials for use by member companies in offshore and estuarine areas. Clean Gulf Associates has contracted, effective August 1, 1972, with Halliburton Services to supply equipment, materials and personnel necessary to contain and clean-up spills in the Gulf of Mexico to the limits of the OCS lying offshore and seaward of the states of Texas, Louisiana, Mississippi, Alabama and Florida.

All of the tracts considered in this proposed lease sale fall within this area. Before any drilling commences, should this proposed sale be held, an inventory of pollution combatting equipment would be stockpiled at a strategic location.

At the present time, Halliburton maintains four types of recovery/clean-up systems for development at three primary bases located at Intercoastal City and Grand Isle, Louisiana, and a subbase at Venice, Louisiana. These include: fast response open sea/bay, high volume open sea, and shallow water skimmer systems and auxiliary shallow water and beach clean-up equipment.

### EFFECTIVENESS OF CLEAN-UP OPERATIONS

The effectiveness of offshore clean-up is weather contingent. The equipment which is now stockpiled and available as well as that which will be built in the near future, is not completely effective in high winds or waves. The average recovery of oil spilled at sea is on the order of 20% (Biglane, 1975).

A major problem of spill clean-up operations involves the disposal of oil contaminated debris. If a spill involves a large quantity of such debris, an acceptable disposal site must be found. The residents of shore communities are becoming increasingly reluctant to commit their disposal sites, which are of limited capacity, to this use. If the debris is not disposed of properly, secondary contamination of surface or ground waters can result.

## Structures

If a ship strays from established safety fai ways, oil and gas platforms can pose a hazard t commercial shipping. This hazard however, i minimized by the fact that safety fairways ar clearly designated on navigation chart Directional drilling from outside safety lanes i used to develop tracts lying partially under safet lanes. Pertinent portions of the Federal Regulations (33 CFR Sec. 209.135(b), 1971) governin shipping fairways and anchorage areas are as follows:

> "The Department of the Army will grant no permits for th erection of structures in the area designated as fairway since structures located therein would constitute obstructions to navigation. The Department of the Army will gran permits for the erection of structures within an are designated as an anchorage area, but the number of structures will be limited by spacing as follows: The center of structure to be erected shall be not less than two (2) nautica miles from the center of any existing structures. In a drillin or production complex, associated structures shall be a close together as practicable having the consideration for th safety factors involved. A complex of associated structures when connected by walkways, shall be considered on structure for the purposes of spacing. A vessel fixed i place by moorings and used in conjunction with the associated structures of a drilling or production complex, sha be considered an attendant vessel and its extent shall include its moorings. When a drilling or production comple includes an attendant vessel and the complex extends mor than five hundred (500) yards from the center of the complex, a structure to be erected shall not be closer than tw (2) nautical miles from the near outer limit of the complex An underwater completion installation in an anchorage are shall be considered a structure and shall be marked with lighted buoy as approved by the United States Coas Guard."

Development of those tracts in the propose sale which lie partially within shipping fairways o anchorage areas will be subject, if leased, t Federal regulations as presented above so far a the placement of structures is concerned. This would help mitigate any potential impact due to the proximity of structures to relatively high frequency sea traffic.

Commercial vessels are required to report to the Coast Guard whenever a casualty results in any of the following: actual physical damage to property in excess of $1,500, material damage effecting the sea-worthiness or efficiency of a vessel, stranding or grounding, loss of life or injury causing any person to remain incapacitated for a period in excess of 72 hours except injury to harbor workers not resulting in death and not resulting from vessel casualty or vessel equipment casualty. Drilling and production platforms (artificial islands) are required to report to the Coast Guard when involved in a casualty or accident and if any of the following occur: if hit by a vessel and damage to property exceeds $1,500, damage to fixed structure exceeds $25,000, material damage affecting usefulness of lifesaving or fire fighting equipment or loss of life.

Under some conditions, offshore structures are an obstacle to commercial fishing activities. Depending on currents and underwater obstacles an offshore structure can remove areas of trawling and purse seining waters. Heavy concentrations of platforms can make trawling and purse seining difficult.

The erection of more structures on the OCS may affect commercial fishing operations. The impact from platforms may be kept to a minimum by allowing only those structures necessary for proper development and production of the mineral resources, and by placing them with due regard to fishing operations and other competing uses which are evident at the time of platform approval.

The Area Oil and Gas Supervisor considers the views of commercial fishing organizations such as the Gulf State Marine Fisheries Committee with regard to placement of platforms. The Supervisor also from time to time requests information from the Department of Commerce, National Oceanic and Atmospheric Administration and National Marine Fisheries Service to be used in his decision making process of approving or disapproving platform installation. Within the constraints of location of the reservoirs and the technology necessary to drill directional wells, the Supervisor is mindful that platform location is an important consideration for commercial fisheries and does make decisions regarding platform location which minimize the impact on the commercial fishing industry.

In an effort to further mitigate the impact of offshore structures resulting from this proposed sale with regard to commercial fishing and other significant existing or future uses of the leased area, a lease stipulation giving effect to the following will be applied to all blocks in this proposed offering in the event they are leased:

> "Structures for drilling or production, including pipelines, shall be kept to the minimum necessary for proper exploration, development and production and to the greatest extent consistent therewith, shall be placed so as not to interfere with other significant uses of the Outer Continental Shelf including commercial fishing. To this end, no structure for drilling or production, including pipelines, may be placed on the Outer Continental Shelf until the Supervisor has found that the structure is necessary for the proper exploration, development, and production of the leased area and that no reasonable alternative placement would cause less interference with other significant uses of the Outer Continental Shelf including commercial fishing. The lessee's exploratory and development plans, filed under 30 CFR 250.34, shall identify the anticipated placement and grouping of necessary structures, including pipelines, showing how such placement and grouping will have the minimum practicable effect on other significant uses of the Outer Continental Shelf, including commercial fishing."

## Pipelines

### Existing Responsibilities

Federal responsibility and authority for gas and oil pipeline routing or operation on submerged coastal lands is vested in a number of agencies, including the following: Department of the Interior, Bureau of Land Management—rights-of-way for pipelines on the OCS, Environmental review and recommendations on all gathering and flow-lines under Secretarial Order 2974; Geological Survey—jurisdiction over producer owned gathering lines and flow-lines on the OCS; U.S. Fish and Wildlife Service—protection of fish and wildlife resources and their habitat through consultation with the Corps of Engineers in the process of issuing Federal permits in navigable waters. U.S. Army Corps of Engineers—issues permits for construction (including pipelines) on OCS and in other navigable waters; Federal Power Commission—grants certificates of convenience and necessity prior to construction of interstate natural gas pipelines; Interstate Commerce Commission—grants approval of the tariff rates for transportation of oil by common-carrier pipelines; Department of Transportation, Office of Pipeline Safety—Operations in the Materials Transportation Bureau—establishes minimum standards for pipeline construction, operation and maintenance; and Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service—protection of marine fishery resources and their habitat (in coordination with the U.S. Fish and Wildlife Service) through consultation with the Corps of Engineers in the process of issuing Federal permits in navigable waters.

At present, the cooperative effort between the Department of the Interior and the Corps of Engineers, and the National Marine Fisheries Service and State conservation agencies is responsible for minimizing the impact of pipeline and other construction in navigable waters of the United States. The Corps of Engineers, through authority of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) asserts authority over, and requires a permit for construction in all navigable waters subject to the Submerged Lands Act (43 U.S.C. 1301) and includes all lands permanently or periodically covered by tidal waters up to the line of mean high tide.

The Environmental Protection Agency reviews and comments on dredging projects in navigable waters in accordance with a memorandum of understanding with the Corps of Engineers dated July 13, 1967.

The National Oceanic and Atmospheric Administration (through its National Marine Fisheries Service) has been vested with responsibility for participation in matters relating to marine and estuarine areas.

The Department of the Interior and its U.S. Fish and Wildlife Service has responsibility and authority under several statutes, including the Fish and Wildlife Act of 1956, the Estuary Protection Act, the Endangered Species Act of 1973, the Migratory Bird Conservation Act, the Fish and Wildlife Coordination Act, the Marine Mammals Protection Act, and various international treaties enacted to preserve, conserve, protect and enhance fish and wildlife resources and their habitat. The Corps of Engineers regulations, 33 CFR 209.120(g)(9); (40 FR 31329), states that ". . . the decision whether to issue a permit on lands which are under mineral lease from the Department of the Interior will be limited to an evaluation of the impact of the proposed work on navigation and national security".

The U.S. Fish and Wildlife Service, with assistance from appropriate State and Federal agencies, including the National Marine Fisheries Service now reviews all applications to the Corps of Engineers for permits to construct pipelines in navigable waters and assesses their potential impact on fish and wildlife resources and the environment. When appropriate, the Agency recommends to the Corps specific modification of project plans which are needed to reduce impact on these resources. Occasionally a project plan is so conceived that significant impact cannot be avoided and at the same time, a satisfactory alternative may not be available; in such cases, a recommendation that the permit not be issued would be appropriate.

**Mitigating Measures**

Federal, State or local authorities or private landowners may take measures to require, depending upon circumstances and location, that pipelines be buried; that archaeological and hazard surveys be conducted; that canals in wetland areas be backfilled where possible; that bulkheads be erected and maintained in marsh areas to prevent saltwater intrusion; that specific types of dredging equipment be used and specific methods for placement or disposal of spoil be required; that beach and dune areas crossed by pipeline be restored; that pipeline installations in sensitive or valuable areas be seasonally timed so as to occur, for example, during low periods of tourist and recreational activities, or prohibited during acute periods of nesting of waterfowl or migrations of fish and wildlife.

The Department will ultimately receive applications for the OCS component of pipelines resulting from this sale, and after considering all factors, may approve pipeline rights-of-way. The procedure for this is outlined in a Memorandum of Understanding between the Bureau of Land Management and the Geological Survey for Outer Continental Shelf Pipelines. The purposes of the Memorandum is to clearly define the administrative and operational roles of the Bureau of Land Management and the U.S. Geological Survey relating to pipelines on the OCS, to provide consistent and standardized procedures, and to minimize or eliminate dual and overlapping functions. The objectives of the Memorandum are to:

Provide an efficient mechanism for approving pipeline routes through the submerged lands of the OCS.

Initiate measures to provide safety and to minimize or eliminate environmental damage which may be associated with the installation and operation of pipelines originating on the OCS.

Be responsive to the interests of the oil and gas industry, other users of the OCS, and the public with respect to pipelines.

Streamline implementation of the regulations and procedures for more efficient and uniform administration of the Department's authority with respect to pipelines.

The Bureau of Land Management's role in pipeline management on the OCS is defined as follows:

Conduct pipeline routing studies and, with the concurrence of the USGS, designate pipeline corridors on the OCS for all pipelines other than flow or gathering lines within the confines of a single lease or group of contiguous leases under unitized operation or a single operator.

Maintain a central office of record for the location of all existing and future pipelines as specified in paragraph I.A. and associated structures on the OCS.

Prepare environmental assessments, pipeline system planning studies, economic studies, and environmental impact statements when necessary or appropriate, prior to approving applications for rights-of-way pursuant to 43 U.S.C. 1-34(c) and 43 CFR 2883.

Receive applications for rights-of-way for pipelines to be installed on the OCS pursuant to 43 U.S.C. 1334(c) and 43 CFR 2883.

After considering the potential impact of the pipelines on the environment, the relationship of the application to existing pipeline routes on the OCS, and other factors, approve or disapprove the application pursuant to 43 CFR 2883.

This memorandum notwithstanding, some potential adverse effects related to OCS induced pipeline sitings occur nearshore and onshore and generally remain outside BLM authority to apply direct mitigatory measures. However, the ability to regulate pipelines on the OCS implies certain influence over the allocation of nearshore and onshore response. The ability represents a management tool with the potential to indirectly mitigate many adverse effects of random pipeline placement in areas beyond BLM authority. The ability to structure one component of a total transportation system permits a greater degree of departmental management, control and environmental responsiveness of federal, industry and state expressions of pipeline requirements and siting policy; offshore and onshore are integrated during pre-planning stages.

The Department plans to optimally structure sale-related pipeline development and locational schemes for tracts leased in this proposed sale as per our responsibility for pipeline system planning on the OCS. Optimum pipeline development is partly a function of offshore and onshore environmental capabilities, operational and economic dictates and the transportation needs of the impacted area. Recognition of these parameters in a coordinated federal, state and industry effort will result in pipeline sitings which recognize zones of least environmental impact and economic feasibility, according to articulated studies, plans, policies and controls. Such an effort is anticipated before the granting of pipeline rights-of-way induced by this proposed sale.

## Special Studies

Several scientific investigations are being conducted in the Gulf of Mexico in order to obtain data that may be used in future evaluations of offshore leasing (Table D-1). These are discussed below.

The first year included mapping and submersible reconnaissance of 16 topographic highs (Table D-2) on the Texas OCS and has been completed. The reconnaissance allowed for visual (operators' reports, videotape and still photographs) characterization of these sites as potentially valuable resources (commercial fish havens, reefs or reef-type communities). Biological and geological sampling was also conducted. Much of this information was utilized in the promulgation of lease stipulations.

In the second year of this study further intensive submersible observations and standard oceanographic measurements will be taken at Southern Bank and Hospital Rock. Bathymetric mapping will be completed for East Flower Garden, Stetson and an unnamed bank. Submersible reconnaissance will be conducted at the Stetson, East Flower Garden, Twenty-eight Fathom Banks and the adjacent unnamed bank. The work is being conducted on this latter group in order to precede anticipated drilling activity.

A second recently completed special study entitled "Compilation and Summation of Historical and Existing Physical Oceanographic Data from the Eastern Gulf of Mexico" summarized available data of the Gulf of Mexico Loop Current, West Florida Shelf Currents, meteorological factors affecting oceanographic conditions, river runoff effects in the MAFLA area, remote sensing data and the results of several drift bottle releases in the Gulf of Mexico. This information is and has been utilized in the planning and development of present and future studies in the MAFLA area. In addition, it has provided substantive information on the evaluation of potential areas of impact.

A third special study, partially funded by the BLM, will attempt to develop the capacity to predict currents in the Gulf of Mexico for use in pollutant trajectory computations.

The onshore coastal zone is diverse and varied in its environmental values and tolerances to pipeline construction. Because of cultural or natural values some areas may be highly suitable for such activity, while other areas may exhibit severe constraints. The control of potential onshore impacts from overland pipeline construction remains in the hands of state and local authorities or landowners, since federal authority over pipeline placement is limited in a shoreward direction to navigable waters and adjacent wetlands. The coastal zone management program presently under development in the five gulf states will provide them with a further mechanism for controlling such potential impacts. Should sufficient production result from the OCS which warrants new pipeline landfalls, BLM will participate with the states in identifying those areas which are most intrinsically suitable for pipelines and related developments onshore.

On December 21, 1974, the Assistant Secretary of the Interior requested that the National Petroleum Council undertake a study concerned with the availability of materials, manpower and equipment necessary for the exploration and production of oil during the subsequent two years. The results of this study were published during September, 1974 by the National Petroleum Council under the title ''Availability of Materials, Manpower and Equipment for the Exploration, Drilling and Production of Oil—1974-1976''.

BLM field offices periodically review information available in their areas concerning several factors, including the availability of materials, manpower and equipment necessary for the conduct of exploration and production activities.

Table D-1 —*Status of BLM Environmental Studies in the Gulf of Mexico and South Atlantic OCS.*

| Title | Contractor | Status |
|---|---|---|
| Bibliography for the Gulf of Mexico OCS. | Environmental Consultants | Final report accepted. |
| MAFLA Environmental Baseline Study. | SUSIO | Final report accepted. |
| MAFLA Baseline and Rig Monitoring | SUSIO | Field sampling complete. |
| South Texas OCS Environmental Studies Geology | USGS, Corpus Christi | Final Report accepted. |
| South Texas OCS, Biology and Chemistry | Texas Universities | Draft Final Report Submitted. |
| South Texas, OCS, Historical Fisheries and Physical Oceanography | NOAA | Draft Final Report Submitted. |
| South Texas OCS Second-Year Environmental Studies, Geology | USGS, Corpus Christi | Sampling initiated in November 1975 and presently ongoing. |
| South Texas OCS Second-Year, Biology and Chemistry | Texas Universities | Field sampling underway, initiated in January 1976. |
| South Texas OCS Second-Year, Ichthyoplankton Survey and Historical Zooplankton Analysis | NOAA | Analysis underway. |
| South Atlantic OCS Conference/Workshop | Research Triangle Institute | Final report accepted. |
| South Atlantic OCS Environmental Studies | Contracts not let | RFP's to be released in April–May 1976. |
| Texas Topographic Highs Study | Texas A&M | Final report accepted |
| Texas Topographic Highs Study, Second Year. | Texas A&M | Sampling underway submersible work scheduled for August 1976. |
| Historical Physical Oceanography of Eastern Gulf of Mexico. | SUSIO | Final report accepted |
| Quality Control of Hydrocarbon Analysis for MAFLA and South Texas OCS Studies. | University of New Orleans | Final report due July 1976. |
| Quality Control of Trace Metal Analysis for MAFLA and South Texas OCS Studies. | Gulf South Research Institute | Final report due September 1976. |
| Multivariate Analysis of MAFLA Water Column Data. | University of Florida | Draft final submitted. |
| Hydrocarbon Analysis of MAFLA Benthos. | University of Michigan | Draft final submitted. |
| Gulf of Mexico OCS Cultural Resource Sensitivity Zone Mapping Project. | Coastal Environments, Inc. | Final report partially received. |

Table D-1 (continued)

Status of U.S. Fish and Wildlife, Office of Biological Services, Environmental Studies in the Gulf of Mexico Region

| Title | Contractor | Status |
|---|---|---|
| Analysis of Onshore, Estuarine and Marine Effects of Coastal and Outer Continental Shelf Oil and Gas Development on Fish and Wildlife Resources and Coastal Ecosystems | The Conservation Foundation<br>Washington, D.C. | Contract Awarded Fall, 1975 |
| Colonial Nesting Sea and Wading Bird Survey | Louisiana State University<br>Cooperative Research Unit<br>Baton Rouge, Louisiana | Interim Report submitted |
| Ecological Characterization of the Chenier Plain of Southwestern Louisiana and Southeastern Texas | Energy Resources Incorporated<br>Cambridge, Massachusetts<br>Louisiana State University<br>Center for Wetland Resources<br>Baton Rouge, Louisiana<br>Bendix Applied Science and Technology<br>Areospace Systems Division<br>Ann Arbor, Michigan | Contract Awarded April, 1976 |
| Development of Methods and Guidelines to Protect Fish and Wildlife Resources and Supporting Habitats during Gas and Oil Operations on Refuges and Other Public Lands | | Contract Awarded Anticipated in August, 1976 |
| The Biological Impacts of Minor Shoreline Structures on the Coastal Environment | | RFP Issued June, 1976 |
| Study to Synthesis Existing Information Related to the Survival of Seagrasses Including their Ecology, Effects of Man's Activities, their Contribution to Fish and Wildlife, an Evaluation of their Functional Role, Monetary Value, and Management. | | RFP Issued June, 1976 |

Table D-1 (continued)

EPA Environmental Study

| Title | Prime Contractor | Status |
|---|---|---|
| Environmental Assessment of an Active Oil Field in the Northwestern Gulf of Mexico (Buccaneer Oil Field) 1975-1980) | Project Manager:<br>Dr. Joseph W. Angelovic<br>Gulf Coastal Fisheries Center<br>National Marine Fisheries Service/NOAA<br>Galveston, Texas 77550 | Pilot Study Completed<br>Study begin April, 1976 |

Table D-2—*Sites surveyed during the first year.*

| | | |
|---|---|---|
| 1. | 29 Fathom Bank— | 92° 29.25′, 28° 08.5′ |
| 2. | 28 Fathom Bank— | 93° 26.4′, 27° 55.0′ |
| 3. | Little Sister— | 94° 14.5′, 27° 52.0′ |
| 4. | 32 Fathom Bank— | 94° 32.0′, 28° 03.7′ |
| 5. | Baker— | 96° 13.5′, 27° 45.0′ |
| 6. | South Baker— | 96° 16.4′, 27° 40.25′ |
| 7. | Aransas— | 96° 27.0′, 27° 35.3′ |
| 8. | Hospital— | 96° 29.0′, 27° 33.2′ |
| 9. | Southern— | 96° 31.05′, 27° 26.05′ |
| 10. | Dream— | 96° 42.5′, 27° 02.5′ |
| 11. | Big Adam— | 96° 48.5′, 26° 57.5′ |
| 12. | Blackfish Ridge— | 96° 46.5′, 26° 52.7′ |
| 13. | Mysterious— | 96° 42.5′, 26° 46′ |
| 14. | Small Adam— | 96° 51.0′, 26° 56.5′ |
| 15. | North Hospital[1] | |
| 16. | East Flower Garden[2] | |

[1] Submersible observations
[2] Mapping not performed

## Other Mitigating Measures

### Special Stipulations

Leases for oil and gas exploration and development are subject to all OCS operating regulations and orders. Additionally, in some cases, the lease may include special stipulations which are considered necessary for the protection of a particular resource or activity.

Section 2(b) of Executive Order 11593 requires that, until inventories and evaluations can be completed, caution should be exercised over federally owned property in order to avoid damage or alteration of cultural resources potentially suitable for inclusion on the National Register of Historic Places. A Department of the Interior study is currently under contract to identify areas of the Gulf of Mexico which contain, or have a high potential for containing, significant historical or archaeological resources.

a. It is proposed that the following stipulations be applied to any lease resulting from this proposed sale for the protection of historical, archaeological or architectural values on the OCS:

> If the Supervisor, having reason to believe that a site, structure, or object of historical or archaeological significance, hereinafter referred to as "cultural resource," may exist in the lease area, gives the lessee written notice that the lessor is invoking the provisions of this stipulation, the lessee shall upon receipt of such notice comply with the following requirements:
>
> Prior to any drilling activity or the construction or placement of any structure for exploration or development on the lease, including but not limited to, well drilling and pipeline and platform placement, hereinafter in this stipulation referred to as "operation," the lessee shall conduct geophysical surveys to determine the potential existence of any cultural resource that may be affected by such operations. All data produced by such geophysical surveys shall be examined by the Supervisor to determine if anomalies are present which suggest the existence of a cultural resource that may be adversely affected by any lease operation.
>
> If such anomalies exist the lessee shall: 1) locate the site of such operation so as not to adversely affect the anomaly identified; or 2) establish, to the satisfaction of the Supervisor, on the basis of further archaeological investigation conducted by a qualified marine archaeological surveyor using such survey equipment and techniques as deemed necessary by the Supervisor, either that such operation will not adversely affect the anomaly identified or that the potential cultural resource suggested by the occurrence of the anomaly does not exist.
>
> A report of the investigation prepared by the marine archaeological surveyor shall be submitted to the Supervisor for his review. Should the Supervisor determine that the existence of a cultural resource which may be adversely affected by such operation is sufficiently established to warrant protection, the lessee shall take no action that may result in an adverse effect on such cultural resource until the Supervisor has given directions as to its disposition.

Archaeological reports covering leases issued as a result of this proposed sale will be submitted to the Supervisor of the USGS and to the Manager of BLM. The Equipment and procedures to be used in conducting archaeological surveys and the format of the reports have been agreed upon by BLM, USGS and the National Park Service, and are published by the Geological Survey Supervisor as Notice to Lessees and Operator 75-3.

The Manager will review these reports and provide the Supervisor with recommendations for protection of any known or potential cultural resources identified therein. The Supervisor will consider these recommendations and any other relevant information at his disposal prior to issuing a permit for operations at a specific location with a lease.

b. Data compilation by the Bureau of Land Management and other studies indicate fishing or hard bank biological communities are located in certain tracts within this proposed lease sale. This stipulation will be applied to tracts 10, 11 and 61 and is designed to protect these areas.

> The lessee agrees that, prior to any drilling activity or placement of any permanent production platform or pipeline, he will submit as part of his exploration and/or development plan, a bathymetry map with an interpretation as to the presence and location (or absence) of hard bank biological communities. After consultation with the Manager, New Orleans OCS Office, Bureau of Land Management, and the Regional Director, U.S. Fish and Wildlife Service, Atlanta, Georgia, the Oil and Gas Supervisor, U.S. Geological Survey, Metairie, La., may approve exploration and/or development plans. During the exploratory and development phases, the lessee will provide the Supervisor with a written log detailing a description of the materials introduced into the marine environment and manner of this disposition.

*To apply to all leases resulting from these lease sales.*

c. Structures for drilling or production, including pipelines and subsea systems, shall be kept to the minimum necessary for proper exploration, development, and production and, to the greatest extent consistent therewith, shall be placed so as not to interfere unnecessarily with other significant uses of the Outer Continental Shelf, including commercial fishing.

To this end, no structure for drilling or production, including pipelines and subsea systems, may be placed on the Outer Continental Shelf until the Supervisor has determined that the structure is necessary for the proper exploration, development, or production of the lease area and that no reasonable alternative placement would cause less interference with other significant uses of the Outer Continental Shelf, including commercial fishing.

### Notices to Lessees and Operators

These notices have the same effect or status as OCS Operating Orders and Regulations and are used when expeditious clarifications or corrections and additions to existing orders and regulations are necessary. By issuing Notices to Lessees and Operators, the extensive amount of time necessary to amend and republish orders and regulations is avoided. An example of a notice to lessees and operators is found in appendix C.

### Departures

A departure (waiver) from OCS orders or other rules of the U.S. Geological Survey, may be granted by the Supervisor when such a departure is determined to be necessary for (30 CFR 250.12(b)): the proper control of a well, conservation of natural resources, protection of aquatic life, protection of human health and safety, protection of property or protection of the environment.

Waivers are technically based decisions and are granted only in situations in which expert judgement determines that better and safer operations would result from operations under the waiver.

### Research on Advanced Technology

The EPA and the Coast Guard are conducting research on more efficient containment and recovery devices (booms and skimmers). The efficiency of booms and skimmers depends on sea state and spill conditions but in any case they are never 100% efficient.

When the results of these studies and any other similar studies so indicate, the requirement for use of better techniques and equipment will be incorporated into the OCS regulations and orders as appropriate. If incorporated, the requirements will be applied to all leases.

### Geophysical Information

The Conservation Division of the Geological Survey is aware of near-surface structural configurations and its effect on drilling, fixed-structural emplacement, pipelines, etc., in relation to the proposed lease tracts. Knowledge of near-surface structural conditions is fundamental to a sound lease management program for the OCS.

Geophysical data which show the shallow structural and sedimentary environment are used to predict, thereby minimizing any geologic hazards to drilling operations and consequent possible dangers to the environment from pollution. When surface and shallow subsurface geologic hazards are properly identified and correlated with surrounding strata, they seldom create insurmountable obstacles for a minimal risk program of exploration and exploitation involving economically attractive structures.

High-resolution geophysical data covering all tracts to be offered for this proposed sale will be purchased by GS and analyzed by GS geophysical personnel. These data provide definitive information on the thickness of unconsolidated sediments; structural configurations of shallow seismic horizons; sea floor anomalies, mud mounds, mud waves and potential slide areas; pipelines and other objects on the sea floor, and suitable locations for bore holes as interpreted from a combined analysis of several geophysical measurements and bathymetry.

Information from these high resolution data are extremely useful in detecting shallow geologic hazards such as potentially unstable bottom conditions (mud waves, etc.), shallow faults, and in some cases, near surface solution cavities. When these features are identified prior to drilling operations or platform construction, the operator is notified so that he can take the necessary action which will further insure that operation will be conducted with maximum safety.

Interpretations of high resolution subbottom profile data which disclose bottom and subsurface conditions posing a special environmental hazard for drilling or production operations in the offshore area will be made available to the Bureau of Land Management prior to the decision to issue a lease, and to the Geological Survey prior to the approval of drilling operations. If it becomes necessary, the District Engineer, Geological Survey, will prohibit the placement of platforms on areas of instability through his authority to issue or not issue permits for platform placement.

A departure (waiver) from OCS orders or other rules of the GS Supervisor may be granted when such a departure is determined to be necessary for (30 CFR 250.12(b)) the proper control of a well; conservation of natural resources; protection of aquatic life; protection of human health and safety, and protection of property and the environment.

### Conservation Practices

In the interest of conservation, the GS Oil and Gas Supervisor is authorized, pursuant to the Code of Federal Regulations, to approve well locations and well spacing programs necessary for proper development, to give consideration to such factors as the location of drilling platforms, the geological and reservoir characteristics of the field, and the number of wells that can be drilled economically, the protection of correlative rights and the minimizing of unreasonable interference with other uses of the outer continental shelf. The Supervisor draws his authority from the following regulations and OCS operation orders:

*30 CFR 250.11* outlines in broad terms the GS Supervisor's authority to control development of the OCS to protect the natural resources of the OCS, and to obtain maximum economic recovery of mineral resources under sound conservation practices.

*30 CFR 250.16* authorizes the GS Supervisor to specify the permissible production of a well. Thereafter, OCS Order No. 11 establishes the production rate control at the Maximum Efficient Rate (MER) of the well or reservoir.

*30 CFR 250.17* deals with well spacing, authorizes approval of well locations, and platform locations and lists factors for consideration in this regard.

*30 CFR 250.30* requires lessee's compliance with OCS Orders and general regulations, and demands all necessary precautions to prevent damage, waste and injuries.

*30 CFR 250.34* requires that lessee submit to the GS Oil and Gas Supervisor exploratory drilling plans, lease development plans and applications for permits to drill prior to these programs. The GS Oil and Gas Supervisor utilizes well information such as electric well logs, core information from other wells previously drilled in the vicinity of the proposed drilling program, geological and geophysical data and other pertinent reservoir information in order to determine the proper number of wells which are necessary for development. Other pertinent data can be prescribed by the superintendent such as bathymetry maps, bottom sediment studies, and special considerations given to areas of biological significance in regards to such things as drilling muds, drill cuttings and other discharges.

*350 CFR 250.50* grants the Director authority to demand pooling or unitization which the Secretary is authorized to require under the OCS Lands Act in the interest of conservation.

*350 CFR 250.51* refers to the unit plan regulations contained in 30 CFR 226 with regard to obtaining approval of units or cooperative agreements.

*30 CFR 250.52* lists purposes for which the GS Supervisor may approve pooling or drilling agreements.

At this time amendments to the OCS Lands Act are before Congress, and among the provisions are several which could be expected to mitigate potential OCS development impacts. Provisions include: (1) that the Secretary of Commerce and the Secretary of the Interior conduct baseline and monitoring studies for all OCS areas and regions which have experienced or are planned to experience future oil and gas leasing, (2) additional safety regulations apply to construction and operation of OCS facilities, (3) the establishment of an offshore oil spill pollution fund. Also included are amendments to the Coastal Zone Management Act of 1972. These amendments would provide for grants to states which are impacted by OCS developments.

### Other Requirements

In addition to the Interior Department's requirements, the operator must comply with applicable navigation and inspection laws and regulations administered by the U.S. Coast Guard. These relate to the safety of personnel and display of prescribed navigational lights and signals for the safety of navigation. Permits to install islands and fixed structures and the drilling of wells from mobile drilling vessels must also be obtained from the U.S. Army Corps of Engineers, which is authorized by the OCS Lands Act to prevent obstruction to navigation. The decision as to whether a permit will be issued by the Corps of

Engineers is based on an evaluation of the impact of the proposed work on navigation and consideration of national security. Pipeline construction must also be in compliance with standards established by the Office of Pipeline Safety Operations in the Materials Transportation Bureau, Department of Transportation. The Department of Labor establishes Occupational Safety and Health Standards which are applicable to OCS operations.

Operators must comply with the requirements of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500; 86 Stat. 816) which establishes a National Pollutant Discharge Elimination System 40 CFR Part 125, F.R. 13528 (1973). This system applies to discharge on the OCS from any point source and requires any persons to obtain a permit from the EPA for the discharge of any pollutant as defined by the Act. Discharges of any pollutant without the necessary permit from EPA is made unlawful by the Act. Pursuant to section 501(b) of the Act, the Department of the Interior has suggested to EPA that the feasibility of a memorandum of understanding between the two agencies be considered in order to facilitate the administration of the NPDES as it applies to discharges arising from OCS lease operations and to minimize any redundancy of efforts by the Geological Survey and EPA. This feasibility study is currently under consideration.

The U.S. Geological Survey also establishes GS Safety Requirements pertaining to OCS operations:

Geological Survey Standard, Outer Continental Shelf No. 1 (GSS-OCS-1) defining the safety requirements for drilling operations in a hydrogen sulfide environment was published in the Federal Register, Vol. 41, No. 42, March 2, 1976. This standard will be referenced in the Hydrogen Sulfide Section of OCS Order No. 2.

# UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

As described throughout this impact statement, certain features of oil and gas operations cause adverse effects which may be considered unavoidable in the light of current operational practices, technology and regulation. Some of the effects of an oil spill are considered unavoidable and are discussed below with other non-oil related impacts.

## Effects on Marine Organisms

It is known that certain oil and gas operations result in temporary increases in turbidity. These operations include the discharge of drilling mud and cuttings and the excavation of pipeline trenches by jetting and dredging. When particulate matter is generated near the water surface, the depth of the penetration of sunlight will diminish. This leads to a decrease in the output of the photosynthetic mechanism of the phytoplankton, resulting in a decrease in primary productivity.

The effect of any decrease in primary production must be considered as an adverse impact. The area involved is unquantifiable but very small and any reduction would only occur locally and would not involve the entire population of marine organisms.

The area to be effected from discharged drill mud and cuttings and pipeline burial cannot be quantified. Several factors determine the possible impact: drill mud composition and weight; water currents; sea conditions; velocity of materials through disposal pipe; water depth of disposal pipe and size of pipe; type of substrate being drilled; size of drill hole and volume of cuttings; geographic location of drilling platform in Gulf of Mexico; and the dispersion rate of drilling mud in the water column.

In order to assess the impact of pipelines, water currents, sea conditions, water depths, bottom sediment and the dispersion rate of bottom sediments in the water column must be considered. The area affected is localized within fifty feet of the particular operation throughout the water column; however, this area may decrease or increase because of the many variables involved. An estimated 50 to 100 miles of new pipeline will be associated with the development of the offered tracts.

If discharge reaches the bottom in sufficient enough quantities, clogging of the respiratory surface and filter-feeding mechanisms in the benthic animals could probably reach a severe level; physiological stress, and possible mortality could result. This impact will be encountered during pipeline jetting operations and will be restricted to the downstream direction of the bottom current. The duration of the turbidity in any given area is usually no longer than a few hours.

Each well drilled from a platform will result in an expanse of cuttings that are released during drilling, which could possibly bury and smother all non-motile benthic forms below it. The cuttings normally form irregular sized mounds, depending on the currents, etc. which make quantification difficult. If the cuttings are different in texture and composition from the surrounding sediment, it may not be colonized by local forms. The significance of such a potential local population shift is unknown.

Exposure of biota to harmful or toxic materials released into the marine environment or coastal marsh such as from accidental spills of crude oil, fuel and solvents will bring about an unquantifiable adverse effect. The effects of heavy concentrations of crude oil and petroleum derivatives, depending on their composition, include lethal toxicity, sublethal effects, coating with weathered oil, long term effects from tar ball formation, and behavioral changes and habitat changes. In addition, more subtle effects of chronic contamination may be serious, but they are not fully understood at this time.

## Wetlands and Beaches

No new pipelines are anticipated to come ashore as a result of this proposed sale. However, should any occur, the unavoidable short-term impacts associated with trenching and backfilling for pipeline construction include the uprooting of all plants and non-motile animals in the path of the pipeline, thereby leaving a barren strip 9 to 12 meters wide. Some slight damage may also be rendered to vegetation in adjacent areas by machinery used in the operation. The long-term impacts may include salt-water intrusion, changes in floral and faunal components and a possible increase in marsh erosion if the canal is not backfilled.

In the event of an onshore oil pipeline leak or spillage at onshore facilities, it is inevitable that the vegetation would be affected to an extent that would be dependent upon the severity of the spill. While a small leak may do little damage, a severe leak may contaminate the substrate and kill the vegetation that comes into direct contact with the oil and several years may be required for recovery. Small animals in contact with the oil would probably be killed.

A considerable number of beaches and barrier islands are located throughout the area encompassed by this proposed sale. There are no tracts offered in this proposed sale that pose a threat to recreational beaches. However, if any of these beaches are contaminated by oil, an undetermined amount of fish and wildlife habitat (primarily birds) will be damaged. Although large numbers of bird deaths from oil spills have not been documented in the Gulf of Mexico, it is highly possible that a large number of deaths would occur should a large spill reach shore.

## Deterioration of Air Quality

The air quality near offshore production sites may be affected should this proposed sale proceed. Although various types of emissions will be unavoidable, they are not expected to significantly contribute to reaching minimum air quality standards. In most cases, these emissions will be local in nature and be quickly dissipated by climatic conditions. Slight additions of emission to the onshore air quality will result from the normal operating procedures of storage, treatment and terminal facilities but should not add significantly to the pollutants already present.

If a natural gas leak or blowout were to occur, degradation would be minimal. It is expected that the methane pollutants would quickly volatilize and drift away. In the case of fire, pollutants would be largely carbon dioxide and water vapor. Oil leaks and oil spills which would not be accompanied by a fire would introduce highly volatile, low molecular weight hydrocarbons such as benzene and toluene into the atmosphere. These lighter fractions of crude oil would undergo some unknown degree of degradation, possibly resulting in photochemical smog. If a spill were to result in a fire, large amounts of particulate carbon and oxides of carbon, along with smaller but unknown amounts of sulfur oxides, nitrogen oxides, evaporate crude oil liquids and partially oxidized compounds would enter the air. Local air quality would be severely degraded during the duration of the fire. The extent of degradation cannot be determined but it is unlikely that it would be high enough to effect land resources or human health. Should a fire occur, the resultant impact would be considered adverse and unavoidable.

## Deterioration of Water Quality

Water quality will be temporarily degraded by resuspension of sediment during pipeline construction and burial. The jetting away of the substrate from beneath the pipeline will result in suspension of sediments which may contain pollutants such as heavy metals and pesticides. The area affected will be in the direction of the current movement. Various other phases of offshore operations (emplacement of re-entry collars, blowout preventers, drilling platforms, etc.) will also cause suspension of bottom sediments in a localized area. The magnitude of deterioration depends on numerous variables, among them bottom type, currents and duration of the activity.

During drilling operations, discharged drill cuttings will adversely affect water quality. The severity of this impact depends upon such factors as the volume and type of mud discharged and the volume and type of cuttings discharged.

The production and discharge of formation waters (oil field brines) may contribute to water quality degradation when released into the Gulf. Produced formation waters may contain toxic substances, heavy metals, dissolved hydrocarbons and inorganic salts. The heavy metals may include cadmium, chromium, copper, lead, mercury, nickel and zinc, although these are generally present in trace quantities (EPA, 1974). The constituents of these brines may vary from formation to formation and within a single formation.

Water quality will also be somewhat affected by chronic pollutants and occasionally by a more significant spill.

## Interference with Commercial Fishing Operations

As described in earlier sections, trawling operations suffer interference and inconvenience from oil and gas operations in several ways. A small area of the sea floor, up to 0.02% (approximately 0.4 hectare) of each tract leased, is occupied by drilling rigs and platforms and is unavailable to trawl fishermen. Based on past exploration success rates, up to 101 hectares of sea floor (less than one percent of the total acreage offered) may be occupied by platforms resulting from this proposed sale. Trawl nets reportedly become snagged on underwater stubs and unburied pipelines, causing damage or loss of the nets. Less frequently, large objects which were lost overboard from petroleum industry boats and platforms are caught in trawling nets, resulting in damage to the net and/or its catch of fish; however, frequency of occurrence of this type of incident is low.

Commercial fishermen would probably not trawl in the area of an oil spill, as spilled oil could coat or contaminate commercial fish species, rendering them unmarketable. This would be another adverse effect to commercial fishing.

## Interference with Ship Navigation

Very little navigational interference can be expected between ships that are utilizing established fairways and drilling rigs and platforms. However, at night, and especially during rough weather, fog and heavy seas, ships which are not navigating the fairways could collide with fixed structures. Also, fishing boats engaged in trawling will be inconvenienced by having to navigate around fixed structures located on fishing grounds. Based on U.S. Geological Survey estimates, 20-50 new platforms could result from this proposed sale; although the increment is small in comparison to the approximately 2,040 platforms existing in the Gulf of Mexico, it still represents a potential increase in possible interference with ship navigation.

## Damage to Historical and Archaeological Sites, Structures, and Objects

Prior to the laying of a proposed pipeline or the drilling of an offshore well, geophysical surveys will be conducted in those areas considered to have a potential for containing cultural resources. These survey records will be analyzed by a marine archaeologist so that loss or damage of these resources may be avoided. Two possibilities for damage to underwater cultural resources will still remain. The first would arise if a cultural resource, for example, an early shipwreck, is encountered in an area of the shelf where expectation of its occurrence is too low to have required a pre-development underwater survey. The chance of this occurring is very low because, at the present time, all tracts leased to a depth of approximately 50 meters will require cultural resource surveys. A study is also underway which will allow for future delineation of high and low probability areas for the offshore occurrence of cultural resources. The second possibility would arise if geophysical instruments failed to record, or if analysis of the survey records failed to interpret a cultural resource in the area surveyed. No estimate of the probability of such an occurrence can be made at this time; however, underwater cultural surveying is a new field and the quality of instrumentation and experience of personnel is steadily improving. The probability of destruction of cultural resources as a result of the above circumstances should be small and will diminish in the future.

Other damage to archaeological resources may result from oil contamination. Historical and archaeological materials which are soiled by an accidental oil spill may not survive subsequent cleaning and restoration efforts. Porous materials contaminated with oil would be difficult if not impossible to date by using carbon dating techniques and a significant loss of scientific knowledge may result. Although the possibility of contamination of cultural resource materials by oil spills exists, this potential is very small. Even if an oil spill occurs, it is uncertain if artifacts lying on the bottom or beneath bottom sediments would be measurably affected by an oil slick covering the water above.

## Interference with Recreational Activities

Interference with recreation is closely related to degradation of aesthetic values. Oil-contaminated beaches, freshly cut pipeline route terminals and other support facilities would normally be avoided by those seeking sites for recreational activities or for recreational development. Disturbance of beaches by pipeline burial operations will be shortlived, relative to recreational use. Oiled beaches may require days, weeks or years for adequate restorations if they become damaged. The uncertainty of accidental spills is applicable to this event also, but if spilled oil ever reached the beach, it would have an adverse effect on recreational opportunities.

The summary risk analysis lists a number of tracts which, because of their proximity to known resources and activities, may result in damage if 1,000 bbls. or more of oil were spilled and drifted toward that resource or activity area. The number of such tracts which could threaten recreational values is listed below by type of value.

Endangered species, 3 tracts
Commercial and sport fishing, 4 tracts
Outdoor recreation, 5 tracts
Cultural resources, 5 tracts

## Degradation of Aesthetic Values

Platforms and drilling rigs may be located in twenty-one tracts included in this proposal lying from six to twenty-seven kilometers offshore. Some of these may be visible from shore. No new pipeline terminals or treatment facilities are expected to be constructed as a result of this proposed sale.

If structure location were to interfere with residential or recreational vistas, the visual effect would probably be considered adverse. However, the incremental addition to what already exists in the region would be small, therefore potential impact is considered minimal.

Spilled oil and debris which would float in the water or wash up on the beach would also severely detract from the scenic values of any local area. Before the natural terrain and vegetation has been completely restored, the effects of pipeline burial will appear as a large scar traversing the beach and coastal lands. Restoration over most of the scarred area will require at least one year. If a pipeline enters a forested shore, the corridor would be visible for as long as the line is maintained and for several years thereafter. Since no new lines are expected to go ashore, these impacts are considered insignificant.

## Conflict with Other Uses of Land

As discussed in the Other Impacts Section regarding induced industrialization in the coastal zone it is anticipated that excess capacity in the existing gas and oil related infrastructure in the coastal zones of the adjacent states are expected to absorb most of the sale related land use inducements. A total of 0-32 hectares (required for 0-2 terminal storage facilities) was identified as the only incremental land use demand induced by the proposed sale. This acreage is very small, and there are undoubtedly alternative sites available in the general areas identified which could host such facilities. If properly sited in accordance with a comprehensive land use plan, these facilities should present no conflict with other land uses.

## Summary

In summary, all unavoidable adverse impacts that will be sustained by the natural environment as a result of routine operations will be relatively localized in their effects. Many will be followed by unhindered natural recovery within relatively short time periods. A massive accidental oil spill could result in severe and widespread damage of major consequence. Therefore, all the tracts identified for oil and gas production in this proposed sale do contain varying degrees and types of adverse impact potentials. Only a massive oil spill accident would result in significant adverse impacts; however, the probability that such a massive spill will occur is relatively low.

# RELATIONSHIP BETWEEN LOCAL SHORT-TERM USE AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The principal short-term use of the proposed sale area will be the extraction of oil and gas from those tracts which prove economically productive. This mineral extraction will contribute to the diminishment of the long-term productivity of the oil and gas resources of the Gulf of Mexico and possibly to marine and coastal resources.

This proposed sale, if implemented, will add approximately 56,658 hectares (USGS estimate) to the current total of almost 3.3 million hectares now under lease. This will account for 2.0% of the total area under lease after the leases of this proposed sale are included.

There are no scientific data available in this area which indicates any trend in productivity or stress to the environment that may be occurring as a result of leasing. However, it can be stated with certainty that any additional platforms that are constructed will add to the "artificial reef" concept and may in fact be enhancing the overall productivity of the area during the life of a constructed platform. Data from the Gulf Universities Research Consortium (1974) provided limited data that infers that no stress or inhibited productivity is occurring as a result of offshore leasing. Beyond this, it is not possible to establish any definite conclusions.

It is recognized that chronic low-level pollution from oil and toxic chemicals will have adverse impacts in certain areas. Again, it is not possible to quantify or estimate the short or long term effects of chronic low-level pollution or even the location of its occurrence.

Assuming the installation of 20 to 40 platforms, approximately 80-160 hectares would be removed from future trawling by commercial fishermen, resulting in a decrease in long-term harvest to the trawl fishermen. However, the addition of the platforms will increase the short-term (10-30 years) productivity for sport fishermen and commercial hand line fishermen. Unburied pipelines beyond the 61 meter contour will provide additional substrate for organisms and may thus increase the long-term productivity for certain benthos.

Disturbance of coastal land by pipeline construction and burial operations (including salt water intrusion) and construction of related onshore facilities (refineries, terminals, etc.) would decrease productivity if any of these facilities should be constructed.

Some leveling out in the number of platforms is expected as older fields become inactive or hydrocarbon production decreases. This is also true in regard to the cumulative numbers and length (in miles) of pipeline coming ashore. In the case of pipelines, as more and more areas begin to approach termination of production, some additional capacity will be available in existing pipelines to carry production from new areas thereby reducing the numbers of new pipelines required from subsequent lease sales. It is not possible to determine at this time if the total number of platforms and pipelines required to develop the OCS areas in the Gulf of Mexico has peaked, but indications are that conditions are approaching a leveling off point.

# IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

## Mineral Resources

Leasing of the proposed tracts in this sale would permit development and extraction of the minerals contained therein. This proposed lease sale could result in production of between 100-200 million barrels of oil and one-three trillion cubic feet of gas which would represent an irreversible and irretrievable commitment of mineral resources.

## Land Resources

It has been estimated that zero-two terminal storage facilities may result from this proposed sale. This would represent a long-term use of land resources, but not an irreversible and irretrievable commitment.

## Fish and Wildlife Resources

An irreversible or irretrievable commitment of fish and wildlife resources and their habitats could occur in the area of a massive oil spill or in an area frequently subjected to chronic low-level oil pollution. However, it is anticipated that once an area recovered from a spill that the natural fauna (excluding an endemic endangered species population) would reoccupy a vacated habitat.

## Cultural Resources

Any damage to archaeological sites will comprise an irretrievable commitment of non-renewable resources.

# ALTERNATIVES TO THE PROPOSED ACTION

## Hold the Sale in Modified Form

### Sale Modification Alternatives

### DELETE TRACTS

The proposed sale could be modified by offering only those tracts which are estimated to be gas producing. This would avoid some of the potential adverse environmental effects related to this proposed sale. It could significantly reduce the potential hazard to the environment from possible oil pollution events that could result from this sale as proposed.

With this modification, the proposed sale could go forward with few adverse impacts expected as a result of oil pollution on the marine and coastal environments, resources and related activities of the area offshore.

This alternative would require the elimination of the 18 tracts estimated to be oil or oil and gas prone and would result in the loss to this proposed sale of the 100-200 million bbl. of estimated undiscovered recoverable reserves of oil.

Development of gas prone tracts only would still require seismic exploration, exploratory drilling, construction of permanent platforms and pipelines, production well drilling, workovers, maintenance and repair work with the attendant potential adverse environmental impacts as discussed in detail throughout this environmental statement for those activities. If this alternative is followed, the overall importance associated with these activities with regard to the environment would be essentially the same as it would be if all the proposed tracts were offered. However, the magnitude of potential impacts would be reduced and the cumulative impacts associated with quantities of waste water effluents and debris, and the numbers of platforms and pipelines required to develop only gas prone tracts, would be fewer.

Tracts could be deleted which are identified by the matrix analysis as having a maximal potential impact. Tracts that have an additive index of 1.44 to 2.00 for oil spills and structures are considered to have a high risk potential for environmental damage. Two tracts (54 and 57) are tentatively considered at this time to have high maximal environmental risk potential as defined in this impact statement (Summary Risk Analysis Section). Two of the tracts (56 and 57) have been identified as hazardous because they are located in areas of unstable bottom sediments. Deletion of these tracts would eliminate the risk of damage to a rig, an oil spill, or loss of life that might possibly occur as a result of this particular geologic hazard.

Acceptance of the alternative to delete all tracts identified as having a maximal potential impact would have the environmental effect of reducing the total number of platforms by approximately one to four, from this proposed sale. It would likewise incrementally reduce the discharges and disposal of waste water, drill cuttings and muds that are estimated to occur along with exploration, development and production. It is not possible at this time to determine what effect the deletion of these tracts would have on the estimated miles and number of pipelines required for this proposed sale, but acceptance of this alternative would probably have little effect on major lines to shore. However, it is possible that deletion of these tracts would eliminate a few (anywhere from one to ten) of the small flow lines that connect platforms with other platforms and eventually with major pipelines to shore. Acceptance of this alternative could eliminate the greatest degree of potential oil spill damage to marsh, estuarine, wildlife refuge and management areas.

Another alternative that would modify the proposed sale would be to offer only those tracts estimated to have a minimal potential impact to the environment. In the case of this sale this alternative would require the deletion of two tracts (54 and 57) which are considered to have a maximal potential impact to the environment and four tracts (3, 36, 55 and 56) which have a moderate potential impact. Removal of these six tracts from this proposed offering would not significantly reduce the estimated quantity of structures, drill cuttings and muds, produced waste water and activities expected to occur if this proposed sale proceeds. The potential hazard to critical resources and use activities of the area due to impact of oil spills would be either eliminated or greatly reduced because of the location of the minimal potential impact tracts to these resources and multiple-use areas. This alternative would allow for reoffering of deleted tracts at a later date following a determination as to the extent of reserves in the general area.

### SUBSTITUTE TRACTS

Tracts with relatively lower potential environmental risk could be substituted for those of higher potential risk. This would result in a reduction of potential environmental harm. It could also mean that, in the event a sale were held, anticipated production of oil and gas resources would not reach production levels deemed necessary or desirable from a sale in the proposed area.

Should it be determined that greater production potential should be sought than is indicated from substitution of a similar number of tracts of relatively lower potential environmental risk and relatively lower oil and gas resource potential, a relatively larger number of tracts would have to be substituted to achieve the production activities, and this could affect a relatively larger area, both offshore and onshore, than under the proposed action. It is possible that there would be more exploratory drilling, more platforms constructed, additional miles of pipelines required and a substantial increase in production activities with an attendant increase in potential adverse environmental impacts as discussed in detail throughout this environmental impact statement for these activities.

The remaining prospective tracts in the Gulf that would be available for substitution under the proposed action are, almost without exception, being considered for lease offering in the near future. Thus, a substitution of available alternate tracts might only delay, not eliminate, further leasing consideration of any tracts replaced by substituted tracts under the proposed action.

## Withdraw the Sale

Another option is to cancel or greatly reduce the size of the proposed sale. This option would reduce future OCS oil and gas production and would thus necessitate reducing energy consumption (Table B-1) by reduced demand or supply shortfalls, or developing alternative energy sources, or some combination of the two.

This section briefly discusses the following alternatives:

1. Energy conservation
2. Conventional oil and gas supplies
3. Coal
4. Nuclear power
5. Oil shale
6. Hydroelectric power
7. Solar energy
8. Energy imports
    - Oil imports
    - Natural gas imports
    - Liquefied natural gas imports
9. Geothermal energy
10. Other energy sources
11. Combination of alternatives

The condensed information presented in the energy alternatives section of this environmental statement are based, unless otherwise noted, on the contract study "Energy Alternatives: A Comparative Analysis by the Science and Public Policy Program of the University of Oklahoma". Copies of this study are available for review in the New Orleans OCS office, and in BLM's Office of Public Affairs in Washington, D.C., and can be purchased for $7.45 from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Stock Number 041-011-00015-4). This study should be considered as an integral part of the alternatives portion of this EIS.

### Energy Conservation

Vigorous energy conservation is an alternative that warrants serious consideration. The Project Independence Report of the Federal Energy Administration claims that energy conservation alone can reduce energy demand growth by 0.7% - 1.2% depending on the world price of oil. Aside from these savings, it is now widely recognized that wasteful consumption habits impose social costs that can no longer be afforded such as pollution and an inequitable distribution of fuel.

The residential and commercial sectors of the economy are often characterized as inefficient energy consumers. Inadequate insulation, inefficient heating and cooling systems, poorly designed appliances and excessive lighting are often noticed in these sectors. Reductions in consumption beyond those induced by fuel price increases could require new standards on products and buildings, and/or subsidies and incentives. These incentives could impose standards for improved thermal efficiency in existing homes and offices and minimum thermal standards for new homes and offices.

Excessive consumption is also evident in the industrial sector where energy inefficient work schedules, poorly maintained equipment, use of equipment with extremely low heat transfer efficiencies, and failure to recycle heat and waste materials are all commonplace. Estimated energy savings of between 10% - 30% may be available in this sector of the economy.

Transportation of people and goods accounts for approximately 25% of nationwide energy use. Energy inefficiency in the transportation sector varies directly with automobile usage. Automobiles, which account for 90% of all passenger movement in the nation, use more than twice as much energy per passenger mile as buses. Moreover, the average car carries only 1.3 passengers. Using short and mid-term conservation measures such as consumer education, lower speed limits, rate and service improvements on public transit and rail freight transit, energy savings of 15% - 25% might be possible.

Other policies which would encourage fuel conservation in transportation could include standards for more efficient new automobiles and incentives to reduce the miles traveled. An important new development in the fuel economy area could be the modification of the standard internal combustion engine. Although such an engine is now in the advanced stages of development, further study by automotive engineers, industry, and concerned federal agencies is necessary before an acceptable engine may be improved.

Significant energy savings are clearly possible through accelerated conservation efforts. The Project Independence Report estimates that conservation alone could result in a 2.2 million barrel per day reduction in petroleum demand by 1985. These savings will be necessary in order to achieve the goals of energy self-sufficiency.

*Environmental Impacts*

The environmental impacts of a vigorous energy conservation program will be primarily beneficial. The exact nature and magnitude of these impacts will depend on whether there is a net reduction in energy use or whether the reduction is accomplished through technological change and substitutions. In the former case, the net impacts will simply be that there are fewer pollutants of all kinds released. As an example, the 2.2 million bbl./day savings by 1985 mentioned above would result in a diminishment of various pollutants by the following amounts (HUD Contract No. H2026R, ''Research Evaluation of a System of Natural Air Conditioning'').

CO - 4 lbs/1000 gals = 189 tons/day
Hydrocarbons - 3 lbs/1000 gals = 142 tons/day
Particulates - 23 lbs/1000 gals = 1088 tons/day
$NO_x$ - 60 lbs/1000 gals = 2838 tons/day
$SO_2$ - 157 lbs/1000 gals = 7426 tons/day

If energy conservation is achieved by technological change or substitution, the net reductions will be those stated above, less the incremental pollutants from other sources, as well as any new pollutants which might arise from these other sources.

**Conventional Oil and Gas Supplies**

Large supplies of oil and gas still remain in the U.S. The U.S. Geological Survey estimates that both onshore and offshore, to a depth of 200 meters, crude oil measured reserves as of December 31, 1974, were 34.25 billion barrels, indicated reserves were 4.64 billion barrels, inferred reserves were 30 billion barrels, and undiscovered recoverable resources ranged from 50 billion barrels with a 95% probability to 127 billion barrels with a 5% probability.

Despite the magnitude of reserves, domestic oil production is likely to continue to decline. All of the twelve oil production forecasts discussed in the Project Independence Blueprint claimed that in the next few years, the U.S. petroleum production decline would continue. Most of these same forecasts predict increasing domestic production by the late 1970's, but only under the most favorable conditions in terms of prices, regulations and environmental constraints.

To substitute directly for the proposed sale, onshore oil production would have to increase by 35 to 120 thousand barrels a day and onshore gas production by 0.5 to 1.1 billion cubic feet a day.

Conventional gas supplies are also expected to decline. The development of new reserves required to meet gas demand will depend on continued development of onshore areas and of commercially viable nuclear stimulation or massive hydraulic fracturing in order to produce natural gas from low permeability reservoirs.

Environmental impacts of oil and gas development may include land subsidence; soil sterilization due to oil and brines, and waste materials released by blowouts, equipment failure, and humand error; disturbance of land by building roads and structures, and pollution of ground and surface water due to poor well construction and oil spills.

**Coal**

Coal is the most abundant energy resource in the United States. Coal deposits underlie nearly 460,000 square miles in 37 states, constitute one-quarter of the known world supply and account for 80% of our proven fuel reserves.

Replacement of the energy expected to be realized from the proposed sale, 11 to 27 million tons of coal per year would be necessary. Though domestic reserves of coal could easily provide this quantity, serious limitations to coal development exist. Coal is often an imperfect substitute for oil or natural gas. In many other cases, coal use is restricted by government constraints; limited availability of low sulphur deposits; inadequate mining, conversion, and pollution abatement technology; and the adverse environmental impacts associated with coal extraction and electricity generation from coal. Coal production is also faced with mining labor problems and strict standards for coal mine safety.

As with other extractable hydrocarbons, the quantity of available coal is a function of coal's market price. Current increase in the market price for coal are making more of the resource base available for domestic consumption.

Public concern over dangerous underground mine conditions inspired the Federal Coal Mining Health and Safety Act of 1969. This legislation has improved underground mining conditions and has therefore reduced the hazards to coal miners. On the other hand, it has also increased the costs of underground coal mining and has given strip mining a competitive advantage over underground mining. Strip mining is far less hazardous to miners than underground mining and hence is subject to fewer of the provisions and regulations of this act.

New strict air quality regulations have diminished the attractiveness of coal. One-third of the domestic coal reserve does not meet the low-sulphur requirement. The two-thirds of this reserve that is environmentally acceptable is located mainly in the Rocky Mountain states and is generally of lower BTU value than eastern coals. The cost of transporting Rocky Mountain coal to population centers of the eastern or western United States adds significantly to its price, putting much of it at a competitive disadvantage with other energy sources.

**Coal gasification and liquefaction**

Technology for conversion of coal into gaseous and liquid hydrocarbons has been established for several decades and a number of relatively low-capacity commercial plants exist in various parts of the world. However, few cost-effective advanced technologies have advanced beyond the pilot plant stage.

Numerous problems remain before commercial development of synthetic fuels from coal can proceed. Specific technical problems must be solved. The cost-effectiveness of synthetic fuels from coal will depend on prices of other fuels, primarily that of oil and natural gas. Control of adverse environmental effects will increase the cost of producing synthetic fuels. Possible constraints on development include resource constraints: availability of skilled workers, raw materials (coal, water, steel), capital; and institutional constraints: governmental policies (energy resource leasing, coal mining regulations, permit procedures, etc.), and the willingness of industry to invest in development of new technologies.

Coal gasification is accomplished by reacting solid coal with steam, oxygen, air, hydrogen, or mixtures of these gases, to produce first a raw gas containing methane, carbon monoxide, hydrogen, carbon dioxide, steam, hydrogen sulfide, and ammonia in varying proportions depending upon the process. Then raw gas is processed to reduce or enhance certain characteristics of these constituents in order to prevent environmental pollution and to produce the type of gas needed for a particular use.

Gaseous fuels with low, intermediate or high energy content can be produced. Low and intermediate gases are produced in a two stage process involving preparation and gasification; a third process, upgrading, is required to produce high-Btu gas.

Among low-Btu gasification processes under development are: Lurgi, Koppers-Totzek (both in commercial use), Bureau of Mines Stirred Fixed Bed and Westinghouse Fluidized Bed. Among high-Btu gasification processes under development are: Lurgi high-Btu gasification process, HYGAS, BI-Gas, Synthane, $CO_2$ Acceptor.

*Coal liquefaction*

As with coal gasification, production of liquid fuels from coal requires either an addition of hydrogen or a removal of carbon from the compounds in the coal. Coal liquefaction can be viewed as a change in the carbon to hydrogen ratio that can be accomplished through one of three reactions: hydrogenation, pyrolysis or catalytic conversion. Of these, only the last is in commercial operation. Among liquefaction processes under development are: Synthoil, H-Coal, Solvent Refined Coal, Consol Synthetic Fuel, COED, TOSCOAL and Fisher-Tropsch.

The primary environmental impacts of coal begin with coal mining. Underground mining may cause land subsidence. Strip mining and open pit mining disrupt large surface areas, causing destruction of the top soil, wildlife habitats and vegetation. Large volumes of mine wastes must be disposed. Water quality problems may arise from damage to the ground water regime, acid mine drainage, and increased runoff and sediment loads in streams. Stripping increases the dust content of the air. Combustion of coal, especially high sulphur coal, releases particulate and gaseous pollutants. Technology to effectively control the pollutants is not completely developed.

### Nuclear Power

The predominant nuclear system used in the U.S. is the uranium dioxide fueled, light water moderated and cooled nuclear power plant. Research and development is being directed toward other types of reactors, notably the breeder reactor and fusion reactors.

As of June 1, 1976, 58 nuclear plants with a capacity of 40,317 MW were licensed to operate. At the end of 1975, nuclear power generated about nine percent of the Nation's electricity. However, about half of the electric power capacity now under construction is nuclear powered. Nuclear power development has encountered delays in licensing and siting, environmental constraints, and manufacturing and technical problems. Future capacity will be influenced by the availability of plant sites, plant licensing considerations, environmental factors, nuclear fuel costs, rate of development of the breeder and fusion reactors, and capital costs. In order to meet future uranium requirements, an increase in exploratory drilling activity will be necessary.

The nuclear capacity required to generate electricity to substitute for OCS sale production is shown below for two cases:

All of the OCS oil and gas were used to generate electricity.

All of the OCS oil and gas were devoted directly to end uses such as oil and gas heating.

The nuclear capacity required to substitute for the electricity which could be generated by the projected oil and gas from this proposed sale would be one to three 1,000-MW plants. The capacity required to substitute for end uses would be one to four 1,000-MW plants. The required amounts of nuclear fuel are shown in Table B-2 for both cases, assuming model 1000-MW light water reactors.

Although nuclear plants do not emit particulates or gaseous pollutants from combustion, the potential for serious environmental problems exists. Some airborne and liquid radioactive materials are released to the environment during normal operation. The amounts released are very small and potential exposure has been shown to be less than the average level of natural radiation exposure. The plants are designed and operated in such a way that the probability of harmful radioactivity releases from accidents is very low. The possible release of radioactivity as a result of an accident must be anticipated in the design of the plant and its emergency systems. Malfunction of the emergency core cooling system has been of particular concern.

Nuclear plants use essentially the same cooling process as fossil-fuel plants and thus share the problem of heat dissipation from cooling water. However, light-water reactors require larger amounts of cooling water and discharge greater amounts of waste heat to the water than comparably sized fossil-fuel plants. The effects of thermal discharges may be beneficial in some cases. Any adverse effects can be mitigated by use of cooling ponds or towers.

Low level radioactive wastes from normal operation of a nuclear plant must be collected, placed in protective containers, and shipped to an AEC storage site and buried. High level wastes created within the fuel elements remain there until the fuel is spent. They are then isolated in a fuel processing plant and stored in liquid or solid form at AEC storage facilities.

Primary residuals from light water reactors are waste heat and radioactive emissions.

For a 1200-MW plant operating at a 75% load factor, a 32% efficient nuclear plant would emit 47.6 x $10^{12}$ Btu's of waste heat annually. In comparison, a 38% efficient fossil-fuel plant would emit 36.5 x $10^{12}$ Btu's of waste heat. Annual radioactive emission for both types of light water reactors (boiling water reactor and pressurized water reactor) are given in Table B-2.1.

### Oil Shale

The nation's vast oil shale resources have not been developed in the past because of the ready availability of low cost oil and gas. However, current needs have given impetus to oil shale development.

Oil shale can be processed in place (in-situ processing) or can be extracted using surface or underground mining and then processed on the surface.

The Green River Formation covering parts of Colorado, Utah, and Wyoming contains an estimated 600 billion barrels of oil shale, and represents the richest deposits in the U.S. An estimated 73% of oil shale lands, containing nearly 80% of the Green River Formation reserves, are federally held. The Department of the Interior, which manages these federal lands, has initiated a prototype oil shale leasing program to make these rich deposits available for development by private industry.

Oil shale development poses serious environmental problems. With surface or conventional underground mining, it is very difficult to dispose of the huge quantities of spent shale, which occupy a larger volume than before the oil was extracted. Inducing revegetation in an area of oil shale development is difficult and may take more than ten years. In-place processing avoids many of these environmental hazards. However, both methods could cause disturbance of underground aquifers and contaminations of ground waters.

Commercial development of the Green River Formation would require significant quantities of water in an area where water availability is already a problem.

The Green River Formation area is sparsely settled. Oil shale development would cause major changes in existing land uses and thus have social and economic repercussions in an area traditionally devoid of large scale industry. In addition, it would disturb wildlife; the Colorado oil shale lands have some of the largest migratory deer and elk herds in the world.

Roads, mining plant sites, waste disposal areas and utility line corridors would disrupt the land's vegetation cover and intensify sediment loads in the area's streams. Disposal of the huge volume of waste water containing dissolved inorganic and organic compounds without degrading natural ground waters would severely strain the region's already scarce water resources. Oil shale mining would raise noise pollution levels and the attendant particulate emissions would lower ambient air quality.

**Hydroelectric Power**

Hydropower is energy from falling water, which is used to drive turbines and thus produce electricity. Conventional hydroelectric developments convert the energy of regulated natural steam flows which fall from a height to produce electric power. Pumped storage projects generate electric power by releasing water from an upper to a lower storage pool and then the water is pumped back to the upper pool for repeated use. A pumped storage project consumes more energy than it generates but converts off-peak, low value energy to high value peak energy.

Many of the major hydroelectric sites operating today were developed in the early 1950's. Thirty to forty years ago, hydroelectric plants supplied as much as 30% of the electricity produced in the U.S. Although hydro plant production has steadily increased, thermal-electric plant production has increased at a faster rate.

As of May 1974, total conventional hydropower developed in the contiguous U.S. was 54,885 megawatts, nearly one half of which was located in the western states of Washington, Oregon and California. Some 6,878 megawatts of conventional hydro capacity are now being installed, about 90% of which is found in the western part of the country.

Much of recent hydroelectric development has been pumped storage capacity. As of May 1974, the total developed pumped storage capacity in the contiguous U.S. was 8,119 megawatts; capacity under construction was 6,253 megawatts. Over 30% of both developed capacity and capacity under construction is in the Middle Atlantic region.

The undeveloped potential for hydroelectric generation is about 93,000 megawatts in the lower 48 states and about 32,000 in Alaska. However, it is likely that hydroelectric power will represent a declining percentage of the total U.S. energy mix due to the following: high capital costs, seasonal variations in waterflow, land use conflicts, environmental effects, water use and flood control constraints. Sites with the greatest production capacity and lowest development costs have already been exploited.

Construction of a hydroelectric dam represents an irreversible commitment of the land resource beneath the dam and lake. Flooding eliminates wildlife habitat and prevents other uses such as agriculture, mining and free-flowing river recreation.

Hydroelectric projects do not consume fuel and do not cause air pollution. However, use of streams for power may displace recreation and other uses. Water released from reservoirs during summer months may change ambient water temperatures and lower the oxygen content of the river downstream, adversely affecting indigenous fish. Fluctuation reservoir releases during peak load operation may also adversely affect fisheries and downstream recreation.

Fish may die from nitrogen supersaturation, which results at a dam when excess water escapes from the draining reservoir. High nitrogen levels in the Columbia and Snake rivers pose a threat to the salmon and steelhead resources of these rivers.

The quantity of hydroelectric energy needed to substitute for the oil and gas expected from the proposed sale depends on whether the oil and gas would be used directly for purposes such as heating or if it were burned to produce electricity, an indirect use. Since direct use is more efficient, substitution in this instance would require a larger quantity of hydroelectric energy in comparison with the case where oil and gas were used to produce electricity.

In order to substitute for end uses, 850-3,400 megawatts per day of hydroelectric energy would be needed. To substitute for the electricity which could be generated by the oil and gas, 656-2,600 megawatts of capacity would be needed.

However, hydroelectric power cannot be substituted for oil and gas in non-transportation users or in industrial uses that depend on the unique properties of oil and gas. Land use priorities often inhibit development. Furthermore, few dams are built solely for hydroelectric power generation. Irrigation, navigation, municipal and industrial uses, and flood control are frequently more important than and not fully compatible with power production needs. Since hydropower is most often used to service peak loads, other energy sources must be relied on for base power loads.

### Solar Energy

Energy from the sun can be used to heat or cool individual buildings and to generate electricity. In the 1940's and 1950's prior to the availability of low cost natural gas, firms selling solar water heaters did a booming business in California and Florida. Commercially installed solar heating and cooling in homes will be in use in many parts of the nation by 1985 and will be more common by 1993. Moreover, intensifying current research and development could hasten these dates by five years (Morrow, 1973). Solar energy will eventually supply 35% to 50% of the nearly 20% of the nation's energy that is now devoted to space conditioning, thus reducing significantly the peak electricity demands of the summer months.

Applications of solar energy must take into account the following: (a) Solar energy is a diffuse, low intensity source, (b) its intensity is continuously variable with the time of day, weather and season, and (c) its availability differs widely between geographic areas.

Potential applications of solar energy show a wide range. Among them are:

Thermal energy for buildings
Water heating, space heating, space cooling, combined systems
Renewable clean fuel sources
Combustion of organic matter
Bioconversion of organic materials to methane
Pyrolysis of organic materials to gas, liquid and solid fuels
Chemical reduction of organic materials to oil
Electric power generation
Thermal conversion
Photovoltaic - residential/commercial, ground central station, space central station
Wind energy conversion
Ocean thermal difference

Because of the energy situation, congressional interest in solar energy research has intensified. The Solar Heating and Cooling Demonstration Act of 1974 legislates a $60 million demonstration program aimed at proving the commercial feasibility of solar heating $5,000-$6,000 (including costs of a standby conventional furnace) compared to $1,000-$2,000 for a conventional fossil-fuel home heating unit. However, the rising cost of gas and oil needed by the conventional heaters means that the initial difference in fixed costs will quickly be overshadowed by the solar systems' lack of fuel costs. Therefore, though more costly at first, the solar unit will be the economical alternative over time.

Additionally, technological change could reduce cost. For instance, one demonstrated direct use of solar energy to heat and cool individual buildings appears to be very successful according to a recently completed study. This study called "Research Evaluation of a System of Natural Air Conditioning" was completed by a professional group from California Polytechnic State University under contract to the Department of Housing and Urban Development (Contract No. H2026R). In part this report states: "Results have shown that this system with minor modifications discovered by this evaluation, is workable from an architectural, a thermal, an economic, and occupancy standpoint at the present time, and that this system could play an important role in energy conservation in the United States without further prototype development.''

What is particularly significant about this scientific report is that it was completed on an occupied California home (Atascadero). It needed no backup system and furthermore used no oil, gas or electricity for heating or cooling throughout a year in which outside temperature ranged from 20° to 99° F. During this period the report states that the indoor temperature at the five foot level cycled less than 4° F daily and the system (''Skytherm'' Systems were invented and patented by Harold R. Hay of Los Angeles, California) was able to keep the indoor temperature between the extremes of 66° F and 74° F except during special test periods or times of prototype breakdown.

Another excerpt from this report states: ''Assuming that the system can be built with no premium, a 1,500 sq. ft. house costing $30,000 on a $6,000 lot carrying an eight percent mortgage of $28,000 on which $20.00/month of utility cost saved is applied as additional payment, would have its loan period reduced from 25 to 19.7 years with an interest savings of about $13,600. If a $30/month utility reinvestment is made possible, the interest saving is about $17,500.

With this system's ''zero'' energy consumption, compared to conventional heating and cooling costs, it is appropriate to calculate the saving in fuel consumption at the point of electricity generation. Production of one KWHR of electricity requires about 13,656 BTU (assuming a 25% rate of efficiency in production and transmission). If one barrel of fuel oil (42 gallons) can produce 6,250,000 BTU then Skytherm in Atascadero is conserving approximately 20 barrels of fuel for annual heating and approximately an additional 10 barrels of fuel for cooling equaling an annual total savings of about 30 barrels.

The faster solar-conditioned houses are added to the housing inventory the greater their input on the total energy consumption for the United States. If, for instance, over a period of 40 years, Skytherm type houses are built at an average rate of 50,000 units per year, the 2 million units will represent 2% of a 100 million total at the end of that period. To the extent that residential use continues to represent about 40% of the national energy consumption, the saving attributable to these type houses would be 0.8% of the national total.

In terms of air pollution, a saving of 1,500,000 (assuming one years construction of 50,000 homes at a savings of 30 barrels per year) barrels (63,000,000 gallons) annually, would cause a reduction in air contaminants (the reduction varies according to the grade of fuel being burned) (Table B-3).

Presently this system has only been proved (according to the report) for the Southwest but other ''Skytherm'' Systems have been conceived for other climates and are in the early development stages.

Other new developments have been undertaken in the State of Colorado with rapid growth in solar homes and office buildings. On the outskirts of Colorado Springs a 30 million dollar hospital complex is being built and will have a 1 million dollar solar heating system. The initial outlay is high but a city official feels that the savings in fuel over a six year period should pay for the system (U.S. News and World Report, June 2, 1975). The city is also requesting Federal financial assistance to install a single central bank of solar collectors to heat 54 low income homes.

The full potential of solar energy can be realized only after large-scale generation of electricity using solar energy becomes technically and economically feasible. In this regard, the Ford Administration has requested $33 million for solar electricity programs in fiscal 1975 - almost $26 million more than the fiscal 1974 appropriation. A number of technical and engineering problems now prevent commercialization of solar steam-electric plants though pilot projects are well underway. It is estimated that solar electricity will be available on a significant scale in 10-15 years. (As a comparison, peak production from this proposed sale will occur five years after leases have been issued).

Solar energy does have a few disadvantages including high capital costs, expensive maintenance on solar collectors, thermal waste disposal, and distortion of local thermal balances being some of the most prominent aspects.

The accelerating real costs of fossil-fuel will continue to increase the attractiveness of the solar energy option. In addition, the environmental impacts of solar energy are relatively less severe than those imposed by the traditional energy sources.

Solar energy cannot substitute for petroleum in all uses, transportation and petrochemicals being the most evident examples. However, as solar energy is used with increasing frequency for heating and electricity generation, oil and gas supplies previously devoted to heating and electricity will be channelled to the petrochemical and transportation industries and other exclusive uses of oil and gas.

## Energy Imports

### OIL IMPORTS

The United States' reliance on imported oil has increased steadily in the last decade. Competition on the world market and cutbacks in Middle Eastern oil exports have raised questions about the availability of oil imports in the future. Declining resource availability and increasing domestic demand restrict potential imports from the Western Hemisphere, particularly Latin America. Increasing imports from the Middle East bring problems of security of supply, balance of payments, U.S. off loading capacity and refinery capacity.

During November 1975, imports of crude oil into the United States amounted to 4.6 millions of barrels per day (FEA, January 1976). The average refiner acquisition cost of imported crude petroleum was $14.66 per barrel during October 1975, indicating a total expenditure for crude oil imports of approximately $67.5 million dollars per day. The crude oil production from this proposed sale is estimated to amount to 30,000 barrels per day, which valued at the average price of $14.66 per barrel, indicates a value of approximately $440 thousands of dollars per day. This amount is an estimate of the current cost of replacing the crude oil production anticipated from this proposed sale with imported crude oil.

Increasing petroleum imports in lieu of OCS development would be contrary to U.S. goals of greater energy self-sufficiency.

The primary environmental hazard of increased oil imports is the possibility of oil spills which can result from intentional discharge, accidental discharge and tanker casualties. Intentional discharges would result largely from tank cleaning operations. The effects of chronic low-level pollution are largely unknown. The worldwide tanker casualty analysis indicates that, overall, an insignificant amount of the total volume of transported oil is spilled due to tanker accidents. However, a single incident such as the breakup of the Torrey Canyon can have disastrous results. With increasing tanker traffic in already crowded harbors, the probability that such an incident could occur is increased.

### NATURAL GAS IMPORTS

During November 1975, imported natural gas amounted to an estimated 80 billion cubic feet, approximately five percent of the total U.S. marketed production of 1,600 billion cubic feet. During 1973, the United States imported natural gas from Canada, Mexico and Algeria.

During September 1975, the average price of natural gas paid by major interstate pipeline companies from domestic producers were 36.5 cents per thousand cubic feet, compared to a price of 141.2 cents per thousand cubic feet paid by Canadian and Mexican sources. The gas production estimated to result from this proposed sale amounts to 360,000 mcf per day. Substitution of imported gas for this volume of production would cost approximately $508 thousand dollars per day.

The environmental impacts of increasing gas imports are derived mainly from the possible increased use of land for pipeline construction and a further possible impact is the risk of explosions and fires.

It is uncertain whether increased quantities of natural gas will be available for import from either Canada or Mexico. Canada has intentions to gradually phase out oil exports to the U.S. which also raises questions regarding their intentions toward natural gas pipeline exports.

### LIQUEFIED NATURAL GAS IMPORTS

The growing shortage of domestic natural gas has encouraged projects to import liquefied natural gas (LNG) under long term contract. Several LNG projects are now under consideration on the Pacific, Atlantic and Gulf coasts. However, the Middle East oil cutback has raised questions concerning the security of foreign LNG. The complexity and length of time involved in implementing these proposals has been increased by the need for negotiating preliminary contracts, securing the approval of the Federal Power Commission and the exporting country, and making adequate provision for environmental and safety concerns in the proposed U.S. facilities.

The environmental impacts of LNG imports arise from tankers; terminal, transfer and regasification facilities; and transportation of the gas. The primary hazard of handling LNG is the possibility of a fire or explosion during transportation, transfer or storage.

Receiving and regasification facilities will require prime shoreline locations and dredging of channels. Regasification of LNG will release few pollutants to the air or water.

LNG imports will influence the U.S. balance of payments. This impact will depend on the origin and purchase price of LNG, the source of the capital, and the country (U.S. or foreign) in which equipment is purchased and LNG tankers are built.

Replacement of the estimated oil and gas production from the proposed sale would entail importing the equivalent of 131-525 million cf per day.

**Geothermal Energy**

Geothermal energy is primarily heat energy from the interior of the earth. It may be generated by either radioactive decay of elements such as uranium or thorium or friction due to tidal and crustal plate motions.

There are four major types of geothermal systems: hot water, vapor dominated, geopressured reservoirs and hot dry rock systems.

Geothermal plants are smaller than conventional plants and require a greater amount of steam to generate the same amount of electricity. This is due to the fact that temperatures and pressures associated with geothermal areas are lower than those created at conventional power plants.

The greatest potential for geothermal energy in the U.S. is in the Rocky Mountain and Pacific regions; some potential exists in the Gulf Coastal Plains of Texas and Louisiana. The Geysers field in California is the most extensively developed source of geothermal energy in the United States and it has been producing power since 1960. Exploration efforts are also underway in the Imperial Valley, Salton Sea, Mono Lake and Modoc County, Calif.

Within 20 years, geothermal energy may account for about one to two percent of total U.S. energy and about five percent of California's total energy consumption.

In order to substitute for end uses of the estimated oil and gas from the proposed sale, 850-3,400 megawatts of geothermal capacity would be needed. To substitute for the electricity which could be generated by the estimated oil and gas, 656-2,600 megawatts of capacity would be needed.

A number of gases are associated with geothermal systems and may pose health and pollution problems. These gases include ammonia, boric acid, carbon dioxide, carbon monoxide, hydrogen sulfide and others. However, adverse air quality impacts are generally less than those impacts associated with sulfide-fuel plants. In addition, saline waters associated with geothermal energy systems must be disposed of and isolated from contact with ground water regimes. Land quality problems stem from disturbance due to the construction of related facilities. Possible ground subsidence, which in turn can cause structural failures and loss of ground water storage capacity, is an additional impact which could occur as a result of utilization of geothermal energy systems.

**Other Energy Sources**

The high costs and rapidly shrinking reserves of the traditional energy fuels have encouraged research into new and different sources for potential energy. Some of these alternate sources have been known for decades but high costs and technical problems have prevented their widespread use.

Environmental impacts of these alternatives are difficult to assess, especially if a great amount of research and development remains to be completed before operational scale systems can be developed, tested and evaluated for production and application.

For the alternatives set forth on Tables B-3 and B-4, the date of commercial availability will depend on the cost of the traditional energy fuels, the level of federally-subsidized research, and the solution of engineering and technical problems. (Tables B-1 and B-2.)

Federal energy research development funding has expanded significantly in the last few years. Tables B-4 and B-5 show funds for different areas of research.

**Combination of Alternatives**

In the interest of clarity of presentation, each alternative form of energy has been discussed separately. However, it is likely that each of these alternatives will be developed to a lesser or greater degree, depending on such variables as the direction and pace of technological development, the identification of undiscovered resources, the rate of national economic growth and the change in lifestyles. The extent to which alternative sources may replace or complement offshore oil and gas is related to the total national energy system. Relevant factors are: Historical relationships indicate that energy requirements will grow at about the same rate as gross national product. Energy requirements can be constrained to some degree through price mechanisms. Other factors such as capital investment may be substituted for energy, for example, insulating to reduce heating/cooling expense. Lower energy use can be effected through rationing, altered transportation modes and major changes in lifestyles. Energy sources are not completely interchangeable. For example solid fuels cannot be used directly in internal combustion engines. Fuel conversion potentials are limited in the short term and are somewhat more flexible in the long term, when choices in energy-consuming capital goods are made. Research and development effort is being directed to energy conversion: more efficient nuclear reactors, coal gasification and liquefaction, oil shale extraction and others. Several of these could assume important roles in the future energy supply, although their future competitive relationship is still uncertain. Major potentials for filling the supply/demand imbalance are: energy conservation, environmentally acceptable systems using domestic coals, accelerated exploration and development of domestic oil and gas resources and development of oil shale. Oil and gas imports entail: security risks related to the reliance for essential energy supplies on sources which are politically unstable and which may interrupt supplies to exert political and economic pressure, aggravation of unfavorable international trade and payment balances, high costs of liquefying and transporting natural gas other than by pipeline over land.

TABLE B-1.—*Energy needed from other sources to replace the expected oil and gas production from the proposed OCS sale No. 44.*

| | |
|---|---|
| | *Billion Btu/day* |
| 1. *Btu equivalents:*[1] | |
| Oil—7,500–30,000 bbl/day | 42–168 |
| Gas—90,000–360,000 thous. cu. ft./day | 92–368 |
| Total | 134–536 |
| 2. *Oil equivalents:* | *Bbl/day* |
| Oil from other sources needed to directly replace expected oil production | 7,500–30,000 |
| Oil from other sources needed to replace expected gas production | 16,400–65,600 |
| Total | 23,900–95,600 |
| 3. *Gas equivalents:* | *MMcf/d* |
| Gas from other sources needed to replace expected oil production | 41–165 |
| Gas from other sources needed to directly replace expected gas production | 500–360 |
| Total | 131–525 |
| 4. *Coal equivalent:* | *Thousand short tons/day* |
| | 5.6–22.3 |
| 5. *Electrical equivalents:* | |
| | *megawatts of capacity* |
| Substitute for end uses[2] | $8.5 \times 10^5$ — $3.4 \times 10^6$ |
| Substitute as input to electricity generation[3] | $6.6 \times 10^5$ — $2.6 \times 10^6$ |

[1] Conversion factors used:
1 barrel of oil = $5.6 \times 10^6$ Btu.
1 cubic foot of natural gas = 1,021 Btu.
1 ton of coal = $24 \times 10^6$ Btu.
1 kilowatt hour = 3,412 Btu at the theoretical conversion rate of other energy forms to electricity at 100 percent efficiency.

[2] Based on a 65 percent average efficiency of end use of oil and gas (such as oil and gas heating) and a plant load factor of 80 percent.

[3] Efficiency of fossil fuel electricity generation was assumed to be 40 percent. Efficiency of present fossil fuel generation averages about 33 percent.

(Insert linofilm folios 28]

TABLE B-2—*Nuclear capacity required to Generate Electricity to substitute for OCS sale 44.*

| | 1 to 3 1,000–MW light water reactors | 1 to 4 1,000–MW light water reactors |
|---|---|---|
| (1) Tons U238 first core fuels -- first year only [1] ---------------- first year only [1] ------------- | 580–1,740 | 580–2,320 |
| (2) Thousands of tons of uranium ore required for (1) [2] ------ | 290–870 | 290–1,160 |

(This comparison has several limitations, among them the difference in lifetime between an OCS oil and gas field (15–20 years) and a nuclear powerplant.)

| | 1 to 3 1,000–MW light water reactors | 1 to 4 1,000–MW light water reactors |
|---|---|---|
| (3) Tons U238 annual reloads without plutonium recycling ------------------------ | 200–600 | 200–800 |
| (4) Thousands of tons of oranium ore required for (3) -------- | 100–300 | 100–400 |
| (5) Tons U308 annual reload with plutonium recycling -------- | 175–525 | 175–700 |
| (6) Thousands of tons of oranium ore required for (5) -------- | 87.5–263 | 87.5–350 |
| (7) Acres of land required for sites only [1] ----------------- | 1,000–3,000 | 1,000–4,000 |
| (8) Cubic feet of high level solid wastes produced yearly ---- | 75–225 | 75–300 |

(Assuming a normalized 1,000 acres per 1,000 MW light water reactor. Of this, 12 acres per year is non-reclaimable.)

---

[1] Assuming 80 percent plant factor.

[2] Assuming 0.20 percent average ore grade.

Table B-2.1

Annual Radioactive Emissions
(for a 1200 MW LSR)

| | BWR (Curies) | PWR (Curies) |
|---|---|---|
| Gaseous Release | | |
| Tritium | 43 | 1100 |
| Carbon-14 | 9 | 8 |
| Iodine | .4 | .19 |
| Noble Bases | 6200 | 4000 |
| Liquid Release | | |
| Tritium | 24 | 420 |

Source: Nuclear Energy Center Site Survey - 1975, Part III, NECSS-75, USNRC, January 1976.

## TABLE B-3

## Energy Alternatives and Federal Energy Research Development Administration Funding (in millions).

| Program area | 1974 |  | 1975 |  | 1976 |  | T.Q. |  |
|---|---|---|---|---|---|---|---|---|
|  | BA | BO | BA | BO | BA | BO | BA | BO |
| Conservation: | 25.4 | 8.6 | 45.5 | 31.8 | 64.1 | 58.4 | 14.7 | 12.7 |
| End use |  |  |  |  | 5.0 | 3.0 | 1.0 | 1.0 |
| Transmission | 3.0 | 1.5 | 12.6 | 6.6 | 13.8 | 13.1 | 2.5 | 2.8 |
| Conversion | 10.9 | 3.8 | 21.4 | 14.7 | 25.0 | 24.4 | 6.5 | 4.5 |
| Storage | 1.7 | 1.5 | 6.6 | 5.6 | 10.1 | 9.0 | 2.0 | 2.1 |
| Automotive | 9.8 | 1.8 | 4.9 | 4.9 | 10.2 | 8.9 | 2.6 | 2.3 |
| Oil, Gas, and Shale: | 11.8 | 11.3 | 33.1 | 21.2 | 36.0 | 32.5 | 9.7 | 9.8 |
| Oil and Gas | 3.1 | 2.6 | 23.7 | 13.6 | 23.9 | 21.0 | 5.9 | 6.2 |
| Oil shale | 3.3 | 2.8 | 5.1 | 2.5 | 9.4 | 8.4 | 2.4 | 2.4 |
| Related programs | 5.1 | 6.0 | 4.0 | 3.7 | 2.4 | 2.7 | 1.4 | 1.1 |
| Trust funds | .2 | −.1 | .3 | .4 | .3 | .4 | .1 | .1 |
| Coal: | 134.5 | 69.9 | 296.3 | 186.3 | 346.8 | 293.2 | 93.9 | 51.0 |
| Combustion | 15.5 | 3.5 | 35.9 | 20.7 | 38.1 | 32.6 | 14.8 | 5.1 |
| Liquefaction | 46.3 | 19.8 | 107.7 | 57.6 | 97.6 | 96.9 | 28.8 | 16.0 |
| Gasification-Hi BTU | 33.3 | 29.4 | 64.4 | 62.4 | 63.4 | 42.8 | 10.5 | 8.7 |
| Gasification-Low BTU | 22.1 | 8.4 | 52.0 | 17.8 | 45.4 | 51.7 | 11.4 | 6.5 |
| Demo program |  |  |  |  | 57.0 | 27.1 | 17.0 | 7.6 |
| Other | 9.9 | 1.5 | 23.3 | 14.8 | 35.4 | 32.1 | 8.9 | 4.6 |
| Trust funds | 7.3 | 7.3 | 13.0 | 13.0 | 10.0 | 10.0 | 2.5 | 2.5 |
| Environmental control (thermal pollution) | 0.2 | 0.2 | 2.3 | 1.8 | 4.9 | 4.1 | 1.4 | 1.2 |

## Table B-3 (continued) Energy Alternatives and Other Federal

| Program area | 1974 | | 1975 | | 1976 | | T.Q. | |
|---|---|---|---|---|---|---|---|---|
| | BA | BO | BA | BO | BA | BO | BA | BO |
| Fisson: | 503.3 | 483.2 | 697.3 | 618.2 | 770.5 | 681.1 | 177.9 | 210.9 |
| LMFBR | 363.2 | 353.6 | 497.2 | 447.5 | 544.0 | 470.0 | 117.2 | 137.2 |
| Other breeders | 2.5 | 3.6 | 13.7 | 9.8 | 11.6 | 12.4 | 3.0 | 3.1 |
| HIGR | 14.9 | 13.1 | 39.0 | 23.1 | 35.0 | 36.6 | 8.8 | 9.8 |
| LWBR | 31.6 | 28.3 | 36.9 | 35.7 | 35.1 | 37.9 | 11.1 | 9.4 |
| Waste management | 10.8 | 7.8 | 16.0 | 14.2 | 22.4 | 20.9 | 6.7 | 5.9 |
| Uranium enrichment | 64.9 | 63.1 | 72.3 | 73.4 | 74.2 | 78.7 | 22.3 | 20.6 |
| Other | 15.4 | 13.7 | 22.2 | 14.5 | 48.2 | 24.6 | 8.8 | 24.9 |
| Fusion | 112.2 | 99.0 | 179.6 | 146.7 | 225.5 | 214.0 | 72.0 | 60.0 |
| Solar, geothermal, others | 18.7 | 11.5 | 71.0 | 26.8 | 101.6 | 92.6 | 27.8 | 19.5 |
| Solar | 7.9 | 4.0 | 38.4 | 8.8 | 70.3 | 57.1 | 20.7 | 14.8 |
| Geothermal | 9.4 | 6.4 | 28.1 | 14.5 | 23.4 | 28.9 | 5.2 | 3.2 |
| Systems studies | 1.1 | .9 | 3.9 | 3.0 | 7.3 | 6.0 | 1.6 | 1.3 |
| Miscellaneous | .3 | .2 | .6 | .5 | .6 | .6 | .3 | .2 |
| TOTAL DIRECT | 806.1 | 683.7 | 1325.1 | 1032.8 | 1549.4 | 1375.9 | 397.4 | 365.1 |
| Environmental effects | 88.5 | 88.1 | 139.9 | 115.0 | 146.1 | 140.9 | 36.6 | 36.5 |
| Basic research | 114.7 | 115.6 | 143.0 | 135.1 | 152.0 | 144.9 | 41.6 | 38.6 |
| Total supporting | 203.2 | 203.7 | 282.9 | 250.1 | 293.1 | 285.8 | 78.2 | 75.1 |

(BA) Budget authority; (TQ) Transition quarter; (BO) Budget outlays.
Source; U.S. Office of Management and Budget, 1976 budget special analysis.

## TABLE B-4 Energy Alternatives and Other Federal Energy Research Development Funding (in millions)

| Program area: agency | 1974 | | 1975 | | 1976 | | T.Q. | |
|---|---|---|---|---|---|---|---|---|
| | BA | BO | BA | BO | BA | BO | BA | BO |
| Conservation: | 20.7 | 18.0 | 32.4 | 22.5 | 23.7 | 24.4 | 5.3 | 5.1 |
| End use: | | | | | | | | |
| DOC | 4.2 | 3.9 | 2.9 | 3.1 | 2.7 | 2.6 | .6 | .6 |
| Transmission: | | | | | | | | |
| NSF | 1.7 | 1.2 | 1.2 | .7 | | 1.0 | | |
| Conversion: | | | | | | | | |
| NSF | 1.2 | 1.1 | 4.5 | 2.0 | 2.0 | 2.0 | .3 | .3 |
| NASA | .4 | .4 | .4 | .4 | .4 | .4 | .1 | |
| Storage: | | | | | | | | |
| NSF | 1.9 | 1.6 | 7.5 | 3.0 | 2.0 | 1.7 | .3 | .2 |
| DOI | | | .3 | .3 | .3 | .3 | .1 | .1 |
| Automotive: | | | | | | | | |
| NSF | .9 | .6 | .9 | .5 | 1.0 | 1.0 | .3 | .3 |
| DOT | 2.2 | 1.4 | 6.5 | 4.5 | 7.0 | 7.0 | 1.7 | 1.7 |
| NASA | 1.9 | 1.9 | .9 | .9 | 1.0 | 1.0 | | |
| DOD | 3.9 | 3.9 | 5.1 | 5.1 | 5.1 | 5.0 | 1.3 | 1.3 |
| EPA | 2.4 | 2.0 | 2.2 | 2.0 | 2.2 | 2.2 | .6 | .6 |
| Oil, gas, shale: | .3 | .3 | 6.4 | 7.3 | 6.6 | 5.3 | 1.6 | 1.6 |
| Oil and gas: | | | | | | | | |
| NSF | .1 | .1 | .3 | .1 | .5 | .3 | .1 | .1 |
| Oil shale: | | | | | | | | |
| DOI | | | 5.6 | 6.9 | 5.6 | 4.6 | 1.4 | 1.4 |
| NSF | | | .3 | .1 | .3 | .2 | .1 | .1 |
| Related: | | | | | | | | |
| DOC | .2 | .2 | .2 | .2 | .2 | .2 | | |

TABLE B-4 (continued) Energy Alternatives and Other Federal Energy Research Development Funding (in millions)

| Program area: agency | 1974 |  | 1975 |  | 1976 |  | T.Q. |  |
|---|---|---|---|---|---|---|---|---|
|  | BA | BO | BA | BO | BA | BO | BA | BO |
| Coal: | 8.4 | 8.2 | 49.8 | 37.8 | 49.4 | 49.2 | 13.2 | 14.4 |
| Mining: |  |  |  |  |  |  |  |  |
| DOI | 7.5 | 7.5 | 42.2 | 31.3 | 42.2 | 42.2 | 11.8 | 12.8 |
| Direct combustion: |  |  |  |  |  |  |  |  |
| NSF |  |  | 1.2 | .9 | 1.0 | .9 | .2 | .3 |
| Liquefaction: |  |  |  |  |  |  |  |  |
| NSF | .3 | .2 | .9 | .6 | .8 | .8 | .2 | .2 |
| Gasification-Hi: |  |  |  |  |  |  |  |  |
| DOC | .2 | .2 | .2 | .2 | .2 | .2 |  |  |
| Gasification-Lo: |  |  |  |  |  |  |  |  |
| NSF | .3 | .2 | .9 | .6 | .8 | .7 | .2 | .2 |
| Other: |  |  |  |  |  |  |  |  |
| AGRI |  |  | 3.8 | 3.8 | 3.8 | 3.8 | .7 | .7 |
| NSF | .1 | .1 | .6 | .4 | .6 | .6 | .1 | .2 |
| Environment: | 65.6 | 58.1 | 101.0 | 34.0 | 78.0 | 90.0 | 22.1 | 25.1 |
| EPA | 65.5 | 58.0 | 99.0 | 32.0 | 73.0 | 85.0 | 22.0 | 25.0 |
| DOI | .1 | .1 | 2.0 | 2.0 | 5.0 | 5.0 | .0 | .1 |
| Fission: | 48.6 | 47.1 | 64.9 | 60.2 | 106.4 | 95.5 | 24.5 | 23.6 |
| LMPBR: DOC | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | .2 | .2 |
| Other: DOI |  |  | 1.1 | 1.1 | 1.1 | 1.1 | .2 | .2 |
| Safety: NRC | 47.6 | 46.1 | 62.8 | 58.1 | 104.3 | 93.4 | 24.1 | 23.2 |

## Delay the Proposed Sale

### Until New Equipment is Available to Provide Increased Environmental Protection

This alternative considers delaying the proposed sale pending the development of new oil spill containment and cleanup equipment. Present equipment is considered adequate for the Gulf of Mexico.

A summary of oil spill containment equipment (USDI, 1975b, Vol. 2, Appendix C) illustrates the capability limits of existing equipment in cleanup operations under conditions of rough water. Most existing oil spill equipment becomes unusable and inefficient when waves exceed 1.2 to 1.8 meters in height and in some cases will not hold together when waves exceed 2.4 meters (Leary, 1975).

#### SUMMARY OF EQUIPMENT

*Modular weir skimmer:* In this operation, oil floating on the surface flows by the action of gravity over an edge, into a sump region and into a storage facility. This operation depends on gravity and would seem of very limited value in turbulent waters.

*Rotating disc skimmers:* The rotating disc skimmer rotates about an axis parallel to the water surface, where it encounters the oil layer. A film of oil clings to the disc surface as it continues along its path through the water, with a wiper assembly removing the oil. This procedure is susceptible to interference by high waves. An indication of specific wave height is not given although mathematical formulation for an estimation is projected.

*Oleophilic belt skimmers:* This instrument consists of a belt which passes through the water first, then absorbs the oil as it passes through a slick. The oil is conveyed to a wringing device for recycling. "Two or more rotating filter-type belts are installed between the catamaran hulls of the self-propelled skimmer craft. Developed by a large corporation, the belt allows water to flow freely through, but captures and removes the oil and oily debris from the surface of the ocean. It is particularly effective in large waves as the force of the waves enhances the skimming action rather than hinders it." (Smith, 1975)

The above author suggests that in waves above 2.4 meters, the skimmer craft will probably not be used. The force of waves in seas of greater turbulence is enough to disperse oil to such an extent that it is not possible to use mechanical means to retrieve the oil, despite the ability of a skimmer to function with reduced efficiency. However, oil dispersed into the water column as a result creates a toxic hazard to offshore fauna and flora.

A series of tests by Leary (1975) on at least three developing methods of high seas oil retrieval gave varied results. The three methods: free vortex, disc drum and weir basin, were required to meet three criteria for high seas testing: to be air transportable in a C-130 aircraft; to recover oil at a maximum rate of 2000 gpm; and to operate on the high seas in a Sea State 4 with winds of 20 knots and a current of 2 knots. However, the system need not operate in a Sea State 6 (Sea State 6 refers to a severe weather condition with winds of 40 knots). A summary of the results of testing in these three high seas devices follows:

*Weir basin:* The weir basin 2000 gpm system (that is weir basin with a recovery goal of 2000 gpm per unit) can be transported by a Coast Guard C-130 aircraft to the point of the spill. The instrument can recover oil approximately one-half inch thick when towed at a one knot current speed. Wave heights during laboratory testing measured 0.6 meters. However, only a reduced model, the W-B 1000 gpm, is currently able to withstand Sea State 6 environment and recovery is not possible at that time. A W-B 2000 gpm cannot withstand high seas at Sea State 6 at this time.

According to Leary's (1975) testing, ". . . with further development, the weir basin system could possibly prove to be a useful device on the high seas especially when towed in a sweeping mode so that a relative current (of two knots) is achieved."

*Disc drum:* The disc drum is a prototype device which has been subjected to high seas testing on the west coast of the U.S. during the early summer, fall and winter of 1973 and early 1974. According to Leary (1975), the tests were for the purposes of examining the system for "structural capability, handleability, seakeeping capability and operational characteristics."

The disc drum was able to recover oil between 0.25 and 2.5 centimeters thick with speeds between one-half and three knots and with three different oils ranging from 8CS to 1000CS. The disc drum has proven sensitive to viscosity and relative current speed in terms of recovery rate. The high seas testing showed very convincingly the reliability of operation and superior handleability of the disc drum system (Leary, 1975).

*Free vortex:* The free vortex is still undergoing research and development but it is anticipated as a high seas oil recovery device.

The effects of water motion on spilled oil has been studied by Leibovick (1975). Some comments from his work are cited prior to the discussion on equipment. From his comments, it will be seen that with greater water movement, oil removal becomes more difficult and eventually impossible despite the strength of operating equipment. "Oil spill removal and control in open water is seldom conducted in 'calm conditions, so the effects of waves and turbulence on the performance of oil spill equipment must be faced..." "...In addition to wave orbital speed and acceleration effects on skimming action, other effects of waves and water turbulence are: "The combined action of wave breaking and turbulence can cause floating oil films to disintegrate and become mixed into the water column as droplets. The extent and importance of mixing depends upon oil type and the vigor of turbulence and wave breaking. Once oil is removed from the surface by natural means in large amounts, containment and cleanup operations are pointless. "Reflections and focusing of short waves is a striking occurrence in containment booms. These effects are analyzed in this paper. Losses due to splash-over can result, and enhance turbulence in the containment region can occur due to wave breaking. Turbulence can lean, as in the previous item, to loss of oil into the water column. With many oils, the addition of mixing energy due to increased wave breaking has the opposite effect of creating a water-in-oil emulsion. Such emulsions have viscosities that are orders of magnitude greater than that of the oil alone, and this leads to dramatic reduction in the pumping rates of removal and transfer equipment. "Observations in wave tanks clearly show that oil thickens in wave crests and is thinned out in the throughs. This is a possible mechanism by which oil films may be broken into patches. A theoretical explanation for this phenomenon is given here. One consequence for oil spill containment is that, since there is relatively more oil in wave crests, splash-over losses are larger than would be expected if the oil thickness was nearly uniform..."

The Department of the Interior has made many changes in its procedures since the 1969 Santa Barbara oil spill, and since receiving and acting on recommendations received in 1974 from the Council on Environmental Quality and others.

U.S. Geological Survey has made revisions to the OCS operating orders and regulations (Appendix B), offshore inspections have been expanded and the offshore effluent limitation guidelines promulgated by EPA have been incorporated into the OCS operating orders. Additional participation has been solicited from both Federal and State agencies for input into the environment impact statement prepared for each lease sale.

### Pending Completion of Studies in the Gulf of Mexico Concerning the Potential Environmental Impacts of Offshore Minerals Development

The proposed sale could be delayed pending completion of all environmental baseline and other special studies in the Gulf of Mexico proposed sale area. The objectives of the Bureau of Land Management's OCS environmental studies program are as follows:

Provide information about the OCS environment that will enable the Department and the Bureau to make better management decisions regarding the development of mineral resources.

Basis for predicting impact of oil and gas exploration and development on the marine environment.

Establish a basis for prediction of impact of OCS oil and gas activities in frontier areas.

Provide impact data that would result in modification of leasing regulations, operating regulations, or operating orders.

The BLM environmental studies effort in the Gulf of Mexico was initiated in May, 1974, with the MAFLA Environmental Baseline Study, and in October 1974 with the South Texas Baseline Study. These studies consist of collecting baseline data for physical and chemical oceanography, geology, plankton, and benthos, and establishing background levels of trace metals and hydrocarbons in sediments, water and biota.

The MAFLA Baseline Study was completed in March, 1975 and the MAFLA Monitoring Study has been initiated. The latter study has not completed all sampling. A final report will be available about December, 1976.

In the South Texas Baseline Study, the separate element (Geology, Biology and Chemistry and Historical Fisheries and Physical Oceanography) reported are complete. The final integrated report will be available in July, 1976. The second-year studies in south Texas began in January, 1976. These will include site-specific monitoring.

In subsequent years, the primary effort of the environmental studies program will be oriented towards baseline and site-specific monitoring. The effort of these programs will be contingent upon the intensity of oil and gas exploration and development activities within the Gulf of Mexico OCS.

This proposed sale could not be held earlier than October, 1976. By October, 1976, the environmental studies program will have been in effect in the Gulf of Mexico for over two years.

The information obtained from the completion of these studies has provided a greater degree of confidence than previously existed concerning the leasing of any given OCS area and the siting of offshore facilities, including pipelines, in relation to geologic, oceanographic, and biotic parameters. The distribution, numbers and seasonal variations of species is useful information not only in the siting of offshore facilities but in determining pipeline routes and burial requirements, and in tract-by-tract evaluations concerning potential environmental impacts from offshore operations. Further information from these studies could prompt deletion of a tract or tracts prior to holding the sale based on unacceptable potential environmental risk.

Information obtained thus far from the environmental studies program has provided information for the formulation of possible stipulations which could provide additional protection of environmental values within the proposed sale area.

### Pending Development of Coastal Zone and Growth Plans Onshore

The proposed sale could be delayed pending the development of coastal zone management and growth plans onshore. Delay of the sale awaiting such plans could result in a greater degree of coordinated planning between the States bordering the Gulf of Mexico and the federal government.

The Coastal Zone Management Act, by which most states are substantially financing their planning, allows the States 3 years, or until 1977 (and possibly until 1978), to develop plans.

It is expected that the coastal zone plan will be relatively flexible, tending toward guidelines rather than "locked in concrete," highly specific zoning ordinances. The onshore facilities that directly affect the state's coastal zone are pipelines, support and staging facilities. Support facilities can be and usually are constructed immediately proceeding a sale or when exploratory drilling commences. Pipelines, pipeline terminals and petroleum storage facilities, and possibly additional support facilities are built after petroleum is discovered, usually 1 to 5 years after a lease sale. These facilities are site-oriented and their location will be determined by the companies and approved by relevant state and local governmental authorities.

Finally, it should be noted that until this proposed sale is held, and until oil and gas are discovered, the size or location of needed facilities cannot be specifically identified by industry. It is expected that facility siting will be decided in accordance with applicable state and local regulations, and if in existence, within the framework of a state coastal zone plan.

## Alternatives Within the Proposed Action

### Government Exploratory Drilling Prior to Leasing

Exploratory drilling conducted by or sponsored by the federal government prior to holding a lease sale would be an alternative within the proposed action. This would involve an alternative approach to one aspect of the present federal leasing system. At the present time, there is little exploratory drilling on the OCS prior to leasing. The United States Geological Survey receives all engineering and geologic data from companies who have drilled on leases issued on the OCS.

These data and geophysical data purchased on the open market are used by the Geological Survey to develop OCS lease policies and to evaluate tracts prior to leasing. For a complete discussion of this alternative see Section VIII.J. of the Final EIS for Proposed Increase on Oil and Gas Leasing in the Outer Continental Shelf (USDI, 1975b, Vol. 2).

# CONSULTATION AND COORDINATION WITH OTHERS

## Preparation of the Draft Environmental Statement

### Federal Agencies

Numerous Federal agencies were contacted for information and suggestions throughout the environmental assessment and statement preparation process. Agencies with the most direct interest were also invited to review sections of the working version of the draft impact statement.

Federal agencies contacted include:

**Department of Commerce**
- National Marine Fisheries Service
- National Oceanographic Data Center
- National Weather Bureau

**Department of Defense**
- U.S. Army Corps of Engineers
- Eastern Sea Frontier Commander
- Naval Oceanographic Office

**Department of the Interior**
- Bureau of Mines
- Fish and Wildlife Service
- Geological Survey
- National Park Service

**Department of Transportation**
- U.S. Coast Guard

**Federal Power Commission**
- Nuclear Regulatory Commission
- Bureau of Natural Gas

### State and local Governments

A letter from the BLM New Orleans OCS Office was sent to the Governor' designated contacts in the Texas and Louisiana area requesting data and information regarding key state programs and resources. These requests were followed by direct requests to specific State agencies.

Continued liaison with state agencies has been maintained. In some cases, contact and information has been provided through a single State agency serving as a clearinghouse for all data requests and input. In other cases, the New Orleans OCS Office contacted individual state agencies each time information or input was needed. The process followed in each case was that requested by the individual or agency named by the respective Governor to coordinate with the New Orleans OCS Office regarding OCS activities. In March 1976, a working draft of the Description of the Proposal (Section I) and a part of the DEIS regarding causes of environmental impact were circulated to State agencies for review.

State agencies that were contacted for information and input include:

**State Agencies**
- Louisiana
  - State of Louisiana Mineral Board
  - State of Louisiana Wildlife and Fisheries Commisssion
  - Advisory Council of Historic Preservation
  - Louisiana State Parks and Recreation Commisssion
  - State of Louisiana Commission of Intergovernmental Relations
- Texas
  - Texas Water Rights Commission
  - Texas Water Quality Board
  - Parks and Wildlife Department
  - Division of Planning Coordination
  - General Land Office
  - University of Texas at Austin—Department of Economic Geology
  - Texas Industrial Commission
  - Texas State Historical Preservation Office
  - Texas Coastal and Marine Council

### Professional and Industry Firms and Association, Academic Institutions, and Others

Institutions and associations which are contacted for information or input include:

- American Petroleum Institute
- American Telephone and Telegraph
- Mobil Oil Co.
- National Audubon Society, Regional Representative
- Shell Oil Co.
- Woods Hole Oceanographic Institute

### Review or Working Draft of the Draft Environmental Impact Statement

The following agencies and groups were invited to review the working draft of the draft environmental impact statement for the purposes of identifying any errors and omissions, or making any suggestions for completeness prior to the draft statement's submission to the Washington BLM headquarters office for formal review and submission to the Council on Environmental Quality.

In the case of the Gulf of Mexico, two states are included in Sale area. Copies of the working draft were sent to the designated contacts within State to coordinate the review by the various State agencies. Staff members of the BLM New Orleans OCS Office met with State personnel in each of the States at various times.

## Coordination and Review of the Draft Environmental Statement Leading to Preparation of the Final Environmental Statement

### Coordination During the Review of the Draft Environmental Statement

The draft environmental impact statement was completed in the spring of 1976 and was filed with the Council on Environmental Quality on June 2, 1976. A notice of its availability was published in the Federal Register on the same date. Approximately 400 sets of the three-volume draft statement were distributed to Federal, State and local agencies, U.S. Congressmen, State officials, industry organizations, libraries, conservation and environmental groups, and others. Comments were requested concerning the draft environmental impact statement and the proposal, and were to be submitted by July 19, 1976.

### Public Hearing

A public hearing was held in New Orleans, Louisiana, on July 7, 1976. The purpose of this hearing was to receive views, comments, and suggestions relative to the environmental impact statement and the proposed action as part of the OCS accelerated leasing program. Franklin P. Mitchels, Administrative Law Judge from the Department of the Interior's Office of Hearings and Appeals, Arlington, Virginia, conducted the hearing. A panel of officials representing the Secretary's Office, U.S. Department of the Interior, the Bureau of Land Management, the U.S. Geological Survey, and the U.S. Fish and Wildlife Service received the testimony.

At the conclusion of each person's testimony, if desired, members of the hearing panel questioned the witness to clarify or expand witness testimony.

Total oral testimony at the public hearing was given by three persons. A complete official transcript of the hearing plus written comments received are available for public inspection at the Bureau of Land Management in the New Orleans Outer Continental Shelf Office, in New Orleans, Louisiana, and in Washington, D.C.

The oral testimonies that were presented reaffirmed industry's interest in Gulf of Mexico exploration. It was also urged that the accelerated OCS leasing program be continued.

Some observations and recommendations that were presented are as follows:

(1) The scope of the sales should be broadened to include tracts appropriate to exploration of lands under lease regardless of whether a well has actually been drilled.

(2) The parameter should be revised to include tracts appropriate to the exploration of acreage under lease in addition to the drainage and development tracts now offered.

(3) The cultural resource stipulation should be changed to include the reason "to believe" requirement. This would enable the supervisor to invoke the stipulation if he has "reason to believe" that a site, structure, or object of historical significance may exist. Surveys of this nature should not be required. Rather, such sites should be identified during the EIS process.

Three reports were submitted for the record, they included:

(1) "Environmental aspects of drilling muds and cuttings from oil and gas extraction operations in offshore and coastal waters," issued by the Offshore Operators Committee. This illustrates documented observations that normal discharge of drilling muds and cuttings do not harm marine organisms.

(2) "Effects of offshore oil and natural gas development on the coastal zone," prepared by the Library of Congress for the House Ad Hoc Select Committee on the OCS. This study concludes that OCS operations are environmentally sound.

(3) A paper by Dr. R. P. Zingula of Exxon Co., U.S.A. relating to the effects of mud and cutting disposal has also been submitted.

### Written Comments Received

In addition to comments received at the public hearing, approximately 30 written comments were received as a result of solicitation by news releases, Federal Register Notices, distribution of the draft statement, and in connection with the public hearing.

### Review and Analysis of Comments Received

Comments and testimony were received mostly from Federal and State agencies, and industry. Comments ranged from support of the statement and the proposal to requests for minor revisions of the statement.

The latter portion of this section contains copies of correspondence received from Federal and State agencies, and other representative organizations and groups regarding the draft impact statement and the proposed action. A listing of persons testifying at the public hearing, and a listing of all written comments received are also included at the end of this section.

All comments and letters received were first reviewed relative to either corrections and editorial changes to the draft statement or issues raised. Where possible and appropriate, the environmental statement has been revised to correct errors and omissions, and to clarify and/or augment discussion of issues of concern. All substantive issues were analyzed to determine revisions necessary to strengthen and improve upon the draft statement. Wherever possible, the final statement reflects consideration given to these issues.

## Issues Concerning Description of the Proposal

Issue No. A-1: The use of existing onshore facilities for products produced from this proposed sale would stabilize, rather than reduce, the quantity of onshore facilities required.

Raised by: U.S. Fish and Wildlife Service

Response: Revisions have been made to Section I.E. to clarify the use of ''reduce'' in this passage.

Issue No. C-1: The reason for selecting the tracts under consideration for lease are not discussed in the statement.

Raised by: Dept. of Commerce

Response: The reasons for selecting the tracts under consideration were reviewed in the section entitled ''Tract Selection Process''. The magnitude of reserves in different areas of the coast are treated in impact statements specific to those areas.

Issue No. G-1: Correction in the lease block location for the proposed Seadock Deepwater Port.

Raised by: Department of Transportation, U.S. Coast Guard U.S. Geological Survey

Response: The location for the proposed Seadock Deepwater Port is in Brazos area, blocks 430 and 459 and Galveston area, blocks 429 and 460. Brazos area, block 439 was listed in error and has been corrected to block 430. Galveston area, block A-144 is not listed in the tract list (Appendix A) to be offered for lease.

## Issues Concerning Description of the Environment

Issue No. A-1: Definition of sandstone and the reservoirs of hydrocarbons should be clarified.

Raised by: Bureau of Mines

Response: In the definition of Geological Terms C. M. Rice defines sandstone as: consolidated rock composed of sand grains cemented together.

Most geologists use Wentworth's definition of sand as unconsolidated rock fragments greater than 1/10 mm and less than 2 mm in diameter.

Therefore, the reservoir for hydrocarbons is sandstone.

Issue No. A-2: Subsidence map shown in Section II.A.3.a. is out of date.

Raised by: Department of the Army Galveston District, Corps of Engineers

Response: A 1973 map showing subsidence in the Houston-Galveston area in the USGS report titled ''Land-Surface Subsidence in the Houston-Galveston Region, Texas'' by R. K. Gabyrsch and C. W. Bonnet, was located in the USGS Houston office as an open file report. This new information has been incorporated in Section II.A.3.a. of the FES.

Issue No. A-3: The New Orleans District of the Army Corps of Engineers' Hurricane Betsy Report indicates a stage of 5.4 ft. mean sea level at Leeville on Bayou Lafourche.

Raised by: Dept. of the Army New Orleans Corps of Engineers

Response: This correction was made in Section II.B.5.

Issue No. A-4: It should be noted that unburied pipelines would more likely be damaged by ship's anchors.

Raised by: Dept. of Commerce

Response: The above mentioned fact has been included in the FES.

Issue No. B-1: The analysis concerning the probability of a tropical storm collapsing or causing a blowout fails to note that if such a destructive storm occurs, it would affect not just one but potentially tens to hundreds of lease sites and potential platforms.

Raised by: Dept. of Commerce

Response: Your argument assumes that every block will have a production platform placed on it. In the history of the development of the Gulf of Mexico, this has not been the case.

Issue No. B-2: The analysis of storms and attendant forces depends on the assumption that the probability of the natural occurring events is adequately described by recurrence relationships. No evidence is given that these are available for the Gulf of Mexico. The material for up to 50 years design lives is necessary, but by no means all of it for 100 and 200 years lives, as required by the assumption.

Raised by: Dept. of Commerce

Response: The analysis was based on the best available information and although certain shortcomings are evident, we feel that the conclusions presented are reasonable.

Issue No. B-3: The climate section gives a general analysis of the Gulf of Mexico is outdated, does not focus on the continental shelf and are too general.

Raised by: Dept. of Commerce

Response: The climate section of the EIS is taken largely from the climate description included in the United States Coast Pilot 5, Eighth Edition, July 1975. New and more detailed data is being presently gathered and this, along with the data from the South Texas study will be included in future statements.

Issue No. C-1: In the discussion on bottom currents it should be pointed out that there is no relationship between bottom and surface currents.

Raised by: U.S. Fish and Wildlife Service

Response: Visual No. 6 on currents is clearly captioned "Surface Currents". However, we have added the following information to our bottom circulation section:

Several recent monitoring efforts in the Gulf of Mexico have shown there may be no apparent relationship of bottom currents to surface currents.

Issue No. C-2: The long term average of the distribution of flow through Southwest and South Passes and Pass-a-Loutre as determined by the New Orleans District of the Corps of Engineers is 3.5, 17.0 and 31.5 percent respectively.

Raised by: Dept. of the Army New Orleans Corps of Engineers

Response: This correction was made in Section II.C.1.b.

Issue No. E-1: List of endangered species revised in September 26, 1975 Federal Register.

Raised by: U.S. Fish & Wildlife Service

Response: Data has been corrected in Section II.E.4.

Issue No. E-2: The recent extinction of the Caribbean monk seal *Monachus tropicalis* and West Indian manatee *Trichechus manatus* and the chronological overlap with offshore oil and gas development should be discussed.

Raised by: Marine Mammal Commission

Response: A discussion concerning the above statement has been included in the test Section II.E.4.

Issue No. E-3: Table E-4 in Section II should include relative abundance, seasonal distribution and primary food resources of the species mentioned. The blue whale *Balaenoptera musculus*, sei whale *Balaenoptera borealis* and the pygmy killer whale *Feresa attenuata* should be included in the table.

Raised by: Marine Mammal Commission

Response: The table has been revised to include the above areas and species mentioned.

Issue No. E-4: *Physeter catodon* and *Globicephala macrorhyncha* are larger cetaceans which should be included in Section II.

Raised by: Marine Mammal Commission

Response: The above mentioned species have been included in the text.

Issue No. F-1: An addition of St. Joseph Island to the list of "Barrier Islands" should be included in Section II.F.5.

Raised by: Dept. of the Army, Corps of Engineers, Galveston District

Response: St. Joseph Island was added to the list of "Barrier Islands" in Sec. II.F. of the FEIS.

Issue No. F-2: Inclusion of San Jose and Brazos Islands in the list of Texas Barrier Islands should be included.

Raised by: U. of Texas at Austin Bureau of Economic Geology

Response: The above mentioned islands have been included in Section II.F.5.

Issue No. F-3: There is a lack of seagrass data for Texas.

Raised by: Texas Parks and Wildlife Department

Response: Additional information has been incorporated into EIS.

Issue No. F-4: The reference to the Mississippi Delta as having the only freshwater marsh in the sale area is erroneous. There are other coastal marshes that are found in the area of the proposed sale.

Raised by: U.S. Fish and Wildlife Service

Response: Examples of other freshwater marshes that are located in the area of the proposed sale have been included.

Issue No. F-5: The six meter elevation line is 48 meters inland is unrealistic.

Raised by: U.S. Fish and Wildlife Service

Response: The statement in Section III.F.1. has been changed to indicate that the six meter elevation line extends 48 km inland.

Issue No. F-6: Use of base-line data from Texas Coastal management Study.

Raised by: Texas Water Rights Commission

Response: A Hearing Draft of the Texas Coastal Management Program has been received. The accompanying maps of areas of particular state concern are of exceptional value and this data will be used to revise the EIS visuals when they are reprinted.

Issue No. F-7: According to Chabreck's map saline marsh does not occur in the Mississippi Delta.

Raised by: Dept. of the Army New Orleans Corps of Engineers

Response: The small band of saline marsh referred to does exist. It probably does not appear on Chabreck's (1972) map due to its small dimensions.

Issue No. G-1: Section II.G.1.a. has two changes that should read: (1) Sand dunes up to 7.6 m and (2) Banks and bluffs up to 7.6 m.

Raised by: U. of Texas at Austin Bureau of Economic Geology

Response: Changes have been made in the text in Section II.G.1.a. from km to read meters for the two figures.

Issue No. G-2: Referencing the Texas and Louisiana Statewide Comprehensive Outdoor Recreation Plans.

Raised by: Bureau of Outdoor Recreation, South Central Regional Office

Response: The Statewide Comprehensive Outdoor Recreation Plans (SCORP) for Texas and Louisiana were basic reference documents used in obtaining data relating to recreation resources potentially affected by this proposed sale. The Texas SCORP provides significant data on recreation use specifically within its coastal zone and we have utilized their planning information in describing recreation activity relating to the proposed sale. Louisiana's SCORP was utilized in obtaining general resource data in the Bayou States Coastal zone. We failed to include a bibliographic reference to the Louisiana SCORP in the DES but this has been corrected in the final statement. We have and will continue to communicate primary recreation planners in those states affected by offshore energy development.

Issue No. G-3: Filling of wetlands has been recognized as detrimental to valuable aquatic ecosystems and legislation has been enacted to minimize such destruction.

Raised by: U.S. Fish and Wildlife Service

Response: A sentence was added to the paragraph discussing land and water use in the Beaumont-Port Arthur area, Section II.G.1.a.

Issue No. G-4: All seven area maps in the Bureau of Economic Geologic Atlas of the Texas Coastal Zone are presently available.

Raised by: The U. of Texas at Austin Bureau of Economic Geology

Response: Section II.G.1.a. has been revised to indicate the availability of all seven area maps in the series—Environmental Geologic Atlas of the Texas Coastal Zone.

Issue No. G-5: Include the Red Wolf on list of endangered species for Anahuac National Wildlife Refuge.

Raised by: U.S. Fish and Wildlife Service

Response: The Red Wolf was added to the list of rare and endangered species occurring on Anahuac National Wildlife Refuge. (Section II.G.3.d.)

Issue No. G-6: Data for the recreational fisheries catch for the Texas coastal zone.

Raised by: Texas Parks and Wildlife Department

Response: Texas Parks and Wildlife has recently developed recreational fisheries catch and effort data for Texas coastal embayments has been included in the description of the Sport Fisheries section on Texas (Sec. II.G.3.a.).

Issue No. G-7: Recent information on Texas port facilities and tonnage handled is available.

Raised by: Texas Industrial Commission

Response: The most recent data available on Texas ports which has the movement of crude petroleum and petroleum products broken out in separate figures is the data which has not been incorporated in place of the 1973 data used in the draft.

Issue No. G-8: Corrections in Section II.G.3.d. concerning the Delta-Breton National Wildlife Refuge and the establishment of Sabine National Wildlife Refuge is 1937 should be included.

Raised by: U.S. Fish and Wildlife Service

Response: The Breton and Delta National Wildlife Refuges have been combined into one, the text has been changed to reflect this.

Issue No. G-9: The Inner Harbor Navigation (Industrial) Canal in the City of New Orleans connects the Mississippi River with Lake Pontchartrain, The Gulf Intracoastal Waterway east of New Orleans and the Mississippi River-Gulf Outlet ship channel.

Raised by: Dept. of the Army, New Orleans Corps of Engineers

Response: This sentence in Section II.G.4.b. has been changed as suggested.

Issue No. G-10: The title of the referenced shoreline study shall be changed to the more recent available version, National Shoreline Study Regional Inventory Reports 1975. The EIS indicates more widespread beach oriented recreational development in southwest Louisiana between Holly Beach and the Mermentau River than is indicated in the shoreline study.

Raised by: Dept. of the Army, New Orleans Corps of Engineers

Response: We have requested from the recreation sections of the District Office the updated version of the "National Shoreline Study, Regional Inventory Reports, 1973". Our future impact statements will reflect the updated data when discussing shoreline resources along the northern Gulf of Mexico. We have corrected the discussions on the degree of development along the beaches of southwest Louisiana.

Issue No. G-11: Amendments to the Act (S. 586. H.R. 3981) have recently been reported out of the conference committee. The amendments establish a new section 307(C)(3)(B), which require any person to submit an exploration or development plan for OCS activity in a manner consistent with approved state programs.

Raised by: Dept. of Commerce

Response: Another CZM related comment concerns amendments to the CZM Act which will apply a similar requirement to OCS development plans.

The general requirement for federal consistency remains as stated, and since these amendments were not in effect when the draft was written, we did not wish to speculate about their detailed application.

Issue No. G-12: The DES briefly describes the National Coastal Zone Management program and federal consistency provisions. However, it does not mention leases within the Coastal Management Act of 1972.

Raised by: Dept of Commerce

Response: This comment refers to the inclusion under the 1972 Coastal Zone Management Act (CZM) of the provision that an applicant for a required federal permit or license to conduct an activity affecting land or water uses in the coastal zone must provide a certification that the proposed activity complies with the state's approved CZM program. The comment also mentions that federal leases are not included under this Act.

Because this EIS is concerned with the proposed offering of federal leases entirely outside the area covered by the CZM Act, and no state with a coastal zone to be affected by this action has as yet received approval from the Secretary of Commerce for its coastal management program, we do not consider a detailed discussion of these provisions appropriate in this context.

Issue No. H-1: The recent stream monitoring data of the Texas Water Quality Board and the Texas Water Development Board show the actual quality of coastal streams and estuaries.

Raised by: Texas Water Quality Board

Response: Section II.H.2. has been changed to indicate the availability of the water quality data that shows the actual quality of coastal streams and estuaries.

Issue No. H-2: The Army Corps of Engineers no longer has authority to issue permits for industrial discharge. This authority now belongs to the Environmental Protection Agency.

The vast majority of the water quality data collected by the NOD is available either as computer printouts in a well organized columnar listing or in tabulations used for internal reports.

The statement, ". . . through its Data Retrieval Program (RAPP)," refers to the original Corps permit program for industrial and municipal dischargers that was taken over by EPA. The RAPP is not related to EPA's data retrieval program.

Raised by: Dept. of the Army, New Orleans Corps of Engineers

Response: These suggestions have been incorporated into Section II.H.2.

Issue No. H-3: The relationship between the municipal and industrial effluents given in tables H-7 and H-8 and the baseline water quality conditions in coastal Louisiana is not readily apparent.

Raised by: Dept. of the Army, New Orleans Corps of Engineers

Response: The tabulated figures were simply intended to show the relative degree of pollution emanating from various localities.

Issue No. I-1: The discussion of the national gas supply situation should be expanded to include current forecasts of future curtailments of deliveries of natural gas by interstate pipeline companies.

Raised by: Federal Power Commission

Response: Section II.I.4.d. has been revised to include information contained in Federal Power Commission News Release No. 22438, dated June 18, 1976.

## Issues Concerning Environmental Impacts of the Proposed Action

Issue No. A-1: The DES does not present an accurate picture regarding the discharge of drilling muds and cuttings.

Raised by: Department of Commerce, U.S. Fish and Wildlife Service Shell Oil Co.

Response: Section III.A.1. of the DES has been changed to incorporate the information provided. See Shell Oil Co. letter in Section IX.B.7.a.

Issue No. A-2: DEIS regarding drill muds are too vague. Additional information is needed regarding periodicity of mud discharged and the quantities to be discharged at each drilling site.

Raised by: Texas Parks and Wildlife Dept.

Response: Additional information regarding the periodicity and quanities of discharges of drill muds has been incorporated in Section III.

Issue No. A-3: A correction should be made to indicate that the Bureau of Mines has not conducted oil seep studies in the Gulf of Mexico.

Raised by: Bureau of Mines

Response: Section III.A.5.e. has been changed to indicate that the oil seep study in the Gulf of Mexico was conducted by the U.S. Geological Survey.

Issue No. A-4: An estimate is given that about 10% of the total volume of drilling mud used in the OCS area may be discharged into the ocean environment. This figure is apparently based on losses during normal drilling operations and does not take into account the possible bulk discharge of drilling muds during drilling and following the completion of a well. We have received indications from, among others, a representative of a company which supplies drilling muds that the bulk discharge of drilling muds is a common practice in the OCS area. This practice would greatly increase the amount of released muds on which the evaluation of drilling mud impact is based.

Raised by: Shell Oil Company, U.S. Fish and Wildlife Service

Response: New data incorporated into statement in Section III.A.1.

Issue No. A-5: The (BAT) regulations are not designed to achieve zero discharge but to achieve reasonable further progress toward the goal of eliminating the discharge of all pollutants. Since the no-discharge is not relevant at this time it should not be discussed.

Raised by: USGS, Reston, Va.

Response: We disagree with this comment. Certain EPA regions are presently requiring NPDES permits for OCS operations and this may soon be applied nationwide.

Issue No. A-6: A substitution concerning oil and/or gas well blowouts during drilling should be included in Section III.A.5.b.

Raised by: USGS, Reston, Va.

Response: This information has been incorporated into Section III.A.5.b.

Issue No. A-7: In Table A-5 and Section III.A.5.f. it is not correct to consider the hydrocarbons discharged with produced waters in concentrations of 50 ppm or less as "oil spillage" and to combine this discharge with estimates of spillage from other sources. There is also no indication that hydrocarbons or discharge on that order of 50 ppm have any detrimental impacts on marine ecosystems.

Raised by: USGS, Reston, Va.

Response: Table A-5 was intended to show hydrocarbon input into the marine ecosystem. Operational discharges, whether harmful or not, should be considered in any analysis of impacts.

Issue No. A-8: It should be noted that floating and/or underwater storage systems are highly unlikely as a result of this proposed sale.

Raised by: USGS, Reston, Va.

Response: This information has been incorporated into Section III.A.6.b.

Issue No. A-9: The underlying unconfined fresh water aquifers have not been mentioned.

Raised by: USGS, Reston, Va.

Response: Due to the shallow depth of pentration of crude oil into beach sands and the short residence time of crude oil on sandy beaches, the effects of spills on coastal aquifers was not considered to be significant.

Issue No. A-10: The draft estimates that ten percent of the drilling mud will be discharged into the marine environment during drilling operations. More accurate estimates should be made of total drilling mud discharges since barite and biocides are associated with this process. Preliminary research results (at EPA's Environmental Research Lab in Gulf Breeze, Florida) have indicated that shrimp ingest large quantities of barium sulfate and that pentachlorophenol, a biocide used in drilling fluids, is toxic to salt-water fishes and may affect the structure and diversity of biota in marine and estuarine communities.

While it is well known that fish are attracted to offshore rigs, little is known about the potential for accumulation by resident food chain organisms of barium, strontium, biocides or other drilled mud constituents. Research is needed to measure the effects of drilling mud discharges on fishes, crustaceans, and corals. Research is needed to measure the effects on humans of consuming seafood harvested from such areas. Previous research has already shown that barium accumulates in mammalian bone and in diatoms (B. D. Lucky, B. Verugopal, and D. Lucky, Heavy Metal Toxicity, Safety and Homology, George Thieme Publishers, 1975).

It has also been reported (Science Vol. 193, No. 4247, p. 57) that, while barium occurs only in trace amounts in the marine environment, it is so persistent that it has recently been proposed as an indicator of previous offshore drilling sites. In addition, some estimates of discharges from oil drilling activities indicate that substantial amounts of barium could be transported great distances (Williams, S. and Jones, J., "Study of Distribution and Origin of Bottom Sediments in the Louisiana Oil Patch Adjacent to Timbalier Bay, Louisiana," sponsored by Gulf Universities Research Consortium in conjunction with the Offshore Ecology Investigation).

Raised by: Environmental Protection Agency

Response: The Bureau of Land Management is currently unable to make an estimate of drilling muds more accurate than 10%. The comments of the Environmental Protection Agency pertaining to the preliminary research results of EPA's Gulf Breeze, Fla. marine lab in the ingestion of barium sulfate by shrimp will be forwarded to the Branch of Environmental Studies in the Bureau of Land Management for consideration in their research program.

Issue No. A-11: Near-coast winds in this region are not more variable than open water winds due to moving cyclonic storms. Rainfall is light and not at all evenly distributed along the South Texas coast. Maximum amounts occur in September.

Raised by: Dept. of Commerce

Response: The statement "Near the coast winds are more variable than over the open waters . . ." comes directly from the Department of Commerce publication, "United States Coast Pilot 5, Eighth Edition—July 1975, p. 75." The statement has been changed to incorporate a statement about seasonal variation.

Issue No. A-12: The July mean air temperature shows little increase coastward from central Gulf; the coast-to-mid Gulf differences in no case approaches 3° C. The January water temperature means in Figure B-1 and discussion fails to show the substantial winter temperature gradient over the continental shelf.

Raised by: Dept of Commerce

Response: The statement in the text does not indicate that there is a 3° C temperature difference between the coast and mid Gulf, rather that there is a 3° C difference in air temperature between coastal land stations and nearby Gulf areas.

Issue No. A-13: There is a conflict involving the maximum depth at which pipelines are buried.

Raised by: Dept. of Commerce

Response: Based on data supplied by NMFS, we have extended the outer limit of trawling areas from 82 to 91 m in Section III.B.9.d. Additionally we have modified our pipeline burial policy (see below). Since BLM is not the only Interior agency permitting pipelines, we have included a discussion on USGS pipeline burial policy on page 46.

USGS has also required trawl tests across unburied lines and have experienced no hangs or snags. NMFS has been invited to participate in these tests as have BLM and La. Shrimp Association.

We also have checked locations supplied in letter of April 23 and found no pipelines in these areas based on our data. As far as experiences in the North Sea with pipelines, we are undertaking a cooperative investigation with industry representatives concerning details of those studies and how they would apply to the Gulf of Mexico.

To: Pipeline Files Date: April 30, 1976

From: Manager, New Orleans OCS Office

Subject: Pipeline Burial Policy—This Office's Area of Responsibility

The basic policy of this office as to pipeline burial is that all lines in water depths up to 200 feet will be buried, unless conditions warrant special consideration.

In water depths exceeding 200 feet and out to the 300 foot depth, all taps and valves will be buried. Should pipelines, valves or taps in any depth range cause repeated interference with commercial fishing activities, their burial may be required by the Manager. This decision will be made on a case by case basis.

In cases where lines, taps and valves are not required to be buried the following parties will be notified:

a. Appropriate state shrimp association and/or state marine fisheries regulatory agency.

b. Mr. Gary L. Graham, Texas Agricultural Extension Service, County Extension Office, Angleton, Texas 77515.

c. Mr. Herman Anderson, U.S. Dept. of Commerce, NOAA—National Ocean Survey, Nautical Chart Division, Rockville, Maryland 20852.

Notices to these parties should state that the data is for information only, that BLM does not guarantee the accuracy of the locations and the BLM will not be responsible for any damage caused by non burial or errors in location.

The requirements set out above are the policies of this office. All correspondence after date of this memo will reflect this position.

/s/ John L. Rankin

Issue No. A-14: It should be noted that the pipeline spill of 160,000 barrels occurred prior to pressure sensor and continuous volume recording requirements, and the reoccurrence of such an incident is highly unlikely.

Raised by: USGS, Reston, Va.

Response: The information has been included in Section III.8.b

Issue No. A-15: It is not true that sodium lignosulfonate has replaced ferrochrome lignosulfonate in a majority of Gulf offshore systems.

Raised by: USGS, Reston, Va.

Response: The statement has been deleted.

Issue No. B-1: Backfill of canals or ditches in marsh areas should be addressed.

Raised by: Texas Parks and Wildlife Department

Response: The statement suggesting it is impossible to backfill all canals or ditches in marsh areas has been changed to: In many cases it is impossible . . .

Issue No. B-2: Impact of pipeline canal dredging should discuss the long-term effects.

Raised by: U.S. Fish and Wildlife Service Texas Parks and Wildlife

Response: Section III.B.6. has been rewritten to reflect the long-term alteration of marsh habitat resulting from pipeline canal dredging.

Issue No. B-3: Impact on Endangered Species—oil contamination of marine turtle eggs.

Raised by: U.S. Fish and Wildlife Service

Response: It is probable that oil spilled in a beach environment will be pressed into the sand, over an undertermined period of time and to an undertermined depth. Most marine turtle nests are fairly deep and above high tide.

Issue No. B-4: The impact on Wildlife Species caused by the loss of upland wildlife habitat should be discussed.

Raised by: Texas Parks and Wildlife Department

Response: Additional information has been incorporated into Section III.B.7.d. pertaining to the impact of habitat loss.

Issue No. B-5: Information regarding the location of brown pelican rookeries should be added.

Raised by: Texas Parks and Wildlife Department

Response: Visual No. 4 for the Western Gulf of Mexico will show the location of brown pelican rookeries along the Texas Coast. The visuals were not available for review with the preliminary DES.

Issue No. B-6: Adverse impact upon alligator populations from devegetation of marsh habitat should be discussed.

Raised by: Texas Parks and Wildlife Department

Response: Additional information has been incorporated into Section III.B.

Issue No. B-7: A correction in Section III.B.9.d. should be made to change 81 m to 61 m as the maximum water depth required for pipeline burial.

Raised by: U.S. Fish and Wildlife Service

Response: Section III.B.9.d. has been corrected to read 61 m (200′).

Issue No. B-8: Impact on benthos of large scale discharge of drilling mud should be discussed.

Raised by: U.S. Fish and Wildlife Service

Response: In the event of a large scale discharge of drilling mud, 800 barrels upon completion of drilling (Otteman, 1976), the major impact would be smothering of benthos adjacent to platform from mud gel. Observations by numerous scientific divers around production platforms have found no apparent long-term impact from smothering, therefore, the impact would be short-term depending on the type and size of benthic assemblage impacted. It appears that the mud is eventually covered by bottom sediments or carried away from drilling operation by ocean currents. The latter would appear to be unlikely due to heavy weight of muds. The toxic effects on a large scale discharge of drill mud would be very localized and temporary at the discharge point depending on composition of mud. The strength of the mud would probably be very weak since it would have been reused extensively and diluted a number of times during the drilling operation.

Issue No. B-9: The reference to PCB's as a heavy metal should be corrected.

Raised by: U.S. Fish and Wildlife Service

Response: The heavy metal cadmium has replaced the reference to PCB in Section III.B.4.

Issue No. B-10 Impact on biologically sensitive areas from the large scale discharge of drilling muds.

Raised by: U.S. Fish and Wildlife Service

Response: Stipulation (b) for biologically sensitive areas will prevent large scale discharges of drilling muds on these areas; therefore, a discussion on impacts has not been included in Section III.B.2.

Issue No. B-11: The potential impacts of warm water effluents should be discussed fully in regards to their impacts.

Raised by: Marine Mammal Commission

Response: The extent of thermal pollution from offshore oil and gas exploration in the OCS is negligible, therefore, extensive discussion concerning the potential impacts is not necessary. The effects of thermal pollution from onshore processing plants is possible, however, since there probably will not be any further development of these onshore facilities discussion of this topic has not been mentioned. Also, the regulation of effluent discharges is under state regulation under EPA guidelines.

Issue No. B-12: The impacts covering marine mammals does not take into account depleted or threatened populations.

Raised by: Marine Mammal Commission

Response: The impact section (Sec. III.B.7.c.) on marine mammals has been rewritten to include a better explanation of impacts caused by oil and gas exploration on the marine mammals in the Gulf of Mexico.

Issue No. B-13: The endangered marine mammals *Trichechus manatus*, *Eubalena glacialis*, *Balaenoptera borealis*, *Balaenoptera musculus*, *Balaenoptera phipolus*, *Megaptera novaeangliae*, and *Physeter catodon* should be included.

Raised by: Marine Mammal Commission

Response: The above mentioned species have been included in Section III.B.8.

Issue No. B-14: The drill times are reversed for test wells and development wells.

Raised by: USGS, Reston, Va.

Response: This error has been corrected in Section III.B.1.

Issue No. B-15: It is stated that the probability of a major oil spill resulting from the proposed sale is uncertain. This statement should be clarified.

Raised by: Dept. of the Army, New Orleans Corps of Engineers

Response: Clarification of this sentence in Section III.B.1. has been attempted.

Issue No. B-16: Three tracts contain parts of offshore fishing banks. We endorse the proposal that "protective environmental stipulations" be included in the leases for these tracts. The EIS concludes, however, that the long-term, indirect impacts of drilling and production operation on reefs and banks cannot be predicted. For these reasons, EPA suggests that these tracts (and others identified in the Summary Risk Analysis section as environmental "high risk" tracts) be deleted from the proposed sale.

Raised by: Environmental Protection Agency

Response: At the suggestion of the Environmental Protection Agency, the Program Decision Option Document (PDOD) will contain the alternatives that the high risk tracts, including those identified as fishing banks, be deleted from the proposed sale.

Issue No. B-17: Areas around unburied pipelines should be included in the list of sea floor areas which must be avoided by commercial fishermen using trawls. Also, trawlers are fishing for brown shrimp in depths beyond 91 m. Royal red shrimp occur in deeper waters off the Mississippi Delta.

Raised by: Dept. of Commerce

Response: Since pipelines have been treated under a separate subsection in Impact on Commercial Fisheries, we have chosen to delete pipelines in this section. Secondly, we are discussing navigational problems and not possible interferences. Pipelines do not present visual navigational conflicts. The title of subsection has been changed to Navigational Conflicts.

The outer limit of trawling has been extended from 82 to 91 m.

Issue No. B-18: A recent study investigating the effects of offshore petroleum platforms on the availability of demersal fishery resources in the North Central Gulf of Mexcio indicates that offshore exploration could cause a decline in shrimp catches.

Raised by: Dept. of Commerce

Response: Massey (personal communications) stated that continual analyses of data showed that there was no consistent density dependent on relationships between platforms and crustaceans. He concluded that variability in catches cannot be explained by platforms, but by other factors, i.e., bottom type or environmental factors he did not measure.

Lastly, Massey has not released his dissertation but only an abstract, and due to the nature of the subject and implications that can be made we have decided not to quote the study at this time. (Massey, L.L. Personal Communication. NOAA, NMFS, Beaufort, N.C.).

Issue No. B-19: The list of underwater obstructions listed should include unburied pipelines since they may also present a hazard to trawls and nets.

Raised by: Dept. of Commerce

Response: Unburied pipelines are considered under pipelines and all unburied pipelines are not necessarily underwater obstructions.

Issue No. B-20: The existence of trawl ''hangs'' should be noted. Also, the Mitigating Measures Section does not mention other bottom fishing obstructions. The possibility of locating submerged well heads and/or emergent platforms that might cause obstructions should be discussed.

Raised by: Dept. of Commerce

Response: Denoting trawl hangs which could be shrimp boats, anchors, taps, etc. in each lease block has no direct relationship to this proposed sale. In the EIS, we discuss impacts that could result from the proposed sale.

Structures include those fixed objects that could result form OCS exploration and development form this proposed sale. Locating these structures adjacent to ''hangs'' refers back to stipulation (c) concerning placement which is treated on case by case basis as directed by Secretarial Order 2974.

Issue No. B-21: The probable damage to the estuary resulting from canal construction should be discussed.

Raised by: Dept. of Commerce

Response: This has been addressed under Section III.B.5. and 6.

Issue No. B-22: The general wind patterns are known and should be utilized in the spill spreading discussion and the matrix analysis.

Raised by: Dept. of Commerce

Response: The general wind patterns are not considered to be reliable enough to be included as a decisive factor in the matrix analysis. This is, oil spills usually occur under anomalous conditions inclusive of wind direction and speed.

Issue No. C-1: A discussion including the merits of increased natural gas production for air quality should be included in thes Section III.C.

Raised by: USGS, Reston, Va.

Response: This has been included and discussed in Section III.C.

Issue No. C-2: The EIS very clearly states that there is currently an air pollution problem along the Texas coast. However, in the discussion of the potential impact of this proposed lease sale on the existing air quality, there is no mention of the contribution of fugitive air emissions, nor operational air emissions resulting from disposal of recovered gases. We assume that the present disposal practices for these gases, dilution of flaring, will contribute to the present air quality problems.

Raised by: Environmental Protection Agency

Response: There is an air pollution problem along some portions of the Texas coast. However, as mentioned in the DES when natural gas is combusted, the products are almost entirely $CO_2$ and water, and any sulfurous gases would be oxidized to $SO_2$. Therefore, in view of this any emissions from the combustion of natural gas in on shore refineries would not contribute significantly to an increased pollution problem.

Issue No. D-1: Residual chlorine in discharged waste waters is not a pollutant and this should be corrected.

Raised by: USGS, Reston, Va.

Response: Section III.D. has been corrected to incorporate this information.

Issue No. D-2: It should be pointed out that BAT no-discharge requirements for produced waters apply only to State waters.

Raised by: USGS, Reston, Va.

Response: The EPA requirement may indeed be applied to OCS operations.

Issue No. D-3: EPA's regulations requires only a minimum of 1.0 ppm residual chlorine and does not specify maximum BOD and suspended solids levels.

Raised by: USGS, Reston, Va.

Response: Section III.D. has been corrected to incorporate this information.

Issue No. D-4: It is incorrect to state that no detailed studies have been made on the impact of mud and cutting discharges.

Raised by: USGS, Reston, Va.

Response: Although no detailed studies have been made on the impact of mud and cutting discharges, several studies have been carried out relating to the impact of drilling mud and cutting discharges on marine environment. These brief indications and explanation of these studies have been incorporated in Section III.D.

Issue No. D-5: Waste waters can contain toxic substances but the majority do not. There are no indications of other than localized short-term impacts from these discharges, even in shallow bays.

Raised by: USGS, Reston, Va.

Response: The fact remains that formation waters may contain toxic material and the potential impact must be considered.

Issue No. D-6: It is estimated that from zero to two terminal storage facilities may be constructed on shore as a result of this proposed sale. We suggest that the Final EIS discuss more thoroughly these proposed actions, their environmental effects and measures which might serve to mitigate any predicted adverse effects.

Raised by: Environmental Protection Agency

Response: After consultation with the Texas Water Quality Board the following statement was compiled.

As indicated in Sec. III.D. of the DES zero to two terminal storage facilities may be constructed on shore as a result of the proposed sale. These facilities could have a slight impact on the water quality in the vicinity. The amount of effluent discharged and the area in which the facility is constructed is a major factor in determining the extent of the impact. These facilities would come under State jurisdiction in regards to effluent discharge. The Water Quality Management Plans (P.L. 92-500) for each respective state (Texas and Louisiana) provides a baseline for the present water quality for each basin. Depending on the location of the terminal facilities mathematical models would be calculated for the particular basin and the water quality of the area can be determined. Since these facilities are located on shore the regulatory power to provide sufficient waste water discharge is regulated by State Water Quality Boards under EPA guidelines.

Issue No. D-7: The presentation on the impact of disposal of produced water does not provide estimates of the pollution effects resulting from such disposal. We suggest that BLM consider performing analyses to determine the area around each platform necessary for the dilution and dispersion of produced water.

Raised by: Environmental Protection Agency

Response: The ''User's Guide and Documentation for Outfall Plume Model'' by Baumgartner et al. 1971, is being acquired by the Bureau of Land Management and will be considered for use in future environmental impact statements to determine an area around each platform necessary for the dilution and dispersion of produced water.

Issue No. G-1: The presence of existing and proposed state park areas and the existence of continued debris that is washed on beach areas and visual pollution caused by erecting structures in the offshore environment should be discussed.

Raised by: La. State Parks and Recreation Commission

Response: The concerns relating to existing and proposed Louisiana State Parks and potential impacts to these coastal recreation resources resulting from this proposed sale are addressed in the impact statement. Federal regulations (30 CFR 250.43) regarding pollution and waste disposal on the outer continental shelf require oil and gas operators to properly treat and dispose of all trash, garbage and sewage according to strict standards established by the Federal Government. This precaution properly adhered to should avoid pollution to the marine environment and abate indiscriminant waste disposal which could cause chronic maintenance problems to shoreline recreation areas. Sec. III.M.4.a. addresses the potential visual pollution of offshore development on onshore resources. The matrix analysis considers visual sensitivity levels for potential structures which might result from this proposed sale.

Issue No. H-1: The second paragraph should clarify why it is impossible to backfill ditches and canals. Backfilling is a desirable alternative currently utilized in coastal Louisiana for reduction or environmental impacts where new land cuts are necessary.

Raised by: Dept. of Army New Orleans Corps of Engineers

Response: The paragraph in Section III.H. has been rewritten.

Issue No. J-1: The DES does not address National Register sites which are presently unknown but which might be affected.

Raised by: Advisory Council on Historic Preservation National Park Service

Response: The text has been changed to consider unknown sites.

Issue No. K-1: It should be noted that permanent platforms located near the top of slopes of small banks or reefs could reduce a fisherman's accessibility to the natural systems. Platforms may also recruit marine animals from the reef, therby reducing the natural reef's potential as a fishing bank.

Raised by: Dept. of Commerce

Response: This information has been incorporated into Section III.K.

Issue No. L-1: Consistency of data regarding onshore economic impact with state figures after coastal zone management program is completed.

Raised by: Texas Industrial Commission

Response: The data that is present in Section III.L.2. concerning onshore economic impact is the most current information available. When further information becomes available a better understanding of the onshore problems can be realized and addressed.

Issue No. L-2: The overall quality of the economic impacts is poor and the economic discussions are developed from basic assumptions which appear incomplete and which may be invalid. It is assumed the oil produced through the lease action will only replace domestic supplies of crude oil and that the action will not result in significant growth of local economics and populations. These assumptions are incorrect.

Raised by: Dept. of Commerce

Response: Among the assumptions required to develop an estimate of the impact of this proposed lease sale on the economy of the adjacent states was a determination as to whether additional offshore production would require the construction of additional refineries and processing facilities, or whether existing facilities would be capable of processing the incremental volumes of raw products. The most probable result of the sale was believed to be replacement for declining domestic onshore production, and a displacement of higher cost imported crude oil. The crude oil that may be produced as a result of the sale therefore, was not perceived to be the cause of additional refinery construction. The possible onshore impacts resulting from oil production in other areas of the Gulf of Mexico were treated in more detail in the impact statements prepared for the MAFLA and South Texas lease sales.

Although the comment points out that greater quantities of crude oil may be discovered than that specified in the draft impact statement, it should also be kept in mind that lesser quantities, or none at all, may also be a result of the proposed sale. The estimates used in the impact statement were based on the estimates provided by the Geological Survey to BLM.

Issue No. L-3: The assumption that as a result of an oil spill, locally adverse social and economic impacts that could result are of low magnitude should be supported by estimates of economic parameters such as net dollar costs of damage of spilled oil to commercial fisheries and coastal land resources.

Raised by: Dept. of Commerce

Response: The difficulties in determinating a precise quantitative estimate of the effects of an oil spill were discussed in the section entitled "Results of Oil Spills in the Gulf of Mexico".

Some measure of the volume of oil related to oil spills in the Gulf of Mexico during the past few years has been included in the section entitled "Mitigating Measures Included in the Proposed Action".

Issue No. L-4: The development scenario proposed is condensed into two short a time frame. The installation of platforms and some development drilling would probably continue until at least 10 years after the proposed sale. The period for pipline installation would be extended.

Raised by: USGS, Reston, Va.

Response: This information furnished to BLM-NO by USGS, Metairie contained only a 5-year projection.

## Issues Concerning Mitigating Measures

Issue No. A-1: FEIS should be expanded to identify the toxic substance to be neutralized and the techniques used to effect neutralization.

Raised by: Texas Parks and Wildlife Department

Response: In the dilute form in which drilling muds are released on the OCS no toxic effects have been found. However, in the view of the possibility of the existence of toxic substances Operating Order No. 7 for the Gulf of Mexico has been revised so that it is similar to the Mid-Atlantic Operating Order No. 7. This order has been incorporated into the text.

Issue No. A-2: The discussion of mitigative measures reported that significant oil spills of more than 15 barrels had occurred while drilling rigs were taking on diesel fuel from a supply rig. The spills occurred when the fuel tank overflowed through a venting line because of the inattentiveness of control room operators. We suggest that preventive measures be taken so that similar spills do not occur. We recommend that such venting lines be drained to collecting basins or reservoirs to contain such overflows.

Raised by: Environmental Protection Agency

Response: Issues on safety and operations which occur on a platform after a lease sale has been awarded come under the purview of the U.S. Geological Survey. The recommendation of the Environmental Protection Agency that venting lines be drained to collecting basins or reservoirs for collecting overflows will be appropriately forwarded to USGS.

Issue No. A-3 The draft EIS presentation of oil spill response under the section entitled "Mitigating Measures" is limited. There is little discussion of shoreline protection, restoration, and wildlife management during a spill, nor expected recovery effectiveness. Statistical programs are available which are capable of predicting recovery effectiveness based on a variety of environmental conditons (Shell Oil has developed such a program). Information from this program should be included in the discussion on spill response and clean-up capabilities. Additionally, site accessibility should be discussed in detail, including time required to respond in given spill scenarios depending upon geographical location. An estimation of equipment availability should also be presented.

Raised by: Environmental Protection Agency

Response: While it is too late to make changes in impact statement No. 44 Gulf of Mexico regarding statistical problems which predict recovery effectiveness based upon a variety of environmental conditions (i.e. Shell Oil Program) the BLM will obtain the program and give it consideration in future impact statements.

Issue No. A-4: Inspections of drilling rigs and related equipment in the Gulf of Mexico are conducted at least once during the drilling of each exploratory well and during drilling of the first development well from a platform.

Raised by: USGS, Reston, Va.

Response: Section IV.A.2. has been rewritten and approved by USGS, Metairie, La.

Issue No. C-1: It should be mentioned that certain oil spills from pipelines are required to be reported to the Office of Pipeline Safety Operations (49 CFR Part 195, Subpart B).

Raised by: Materials Transportation Bureau

Response: As currently written, the 40 CFR Part 195, Subpart B, it is not clear whether these regulations apply to the OCS. The new proposed regulations have been published in the Federal Register (oil, Sept. 23, 1975 and gas, October 1, 1975) to clarify the definition of "offshore". At this time operations are not required by these regulations (49 CFR, Part 195) to report spills to the Office of Pipeline Safety Operations.

Issue No. C-2: Recommendations concerning studies to determine the impact of non-buried pipelines on trawls, the effects of pipeline construction on estuarine species. Information gaps have been outlined by the U.S. Fish and Wildlife Service.

Raised by: U.S. Fish and Wildlife Service

Response: BLM has taken under consideration recommendations as outlined in your response.

Issue No. C-3: The Corps of Engineers regulations 33 CFR 209.120(g)(9); (40 FR 31329) should be noted. Coordination through National Marine Fisheries Service with Fish and Wildlife Service when reviewing Corps of Engineers permit applications should be included.

Raised by: Dept. of Commerce

Response: This information has been corrected in Section IV.C.2.

Issue No. D-1: A detailed study should be conducted to define the impact of drilling muds. They should include analysis of the distribution and direct impacts of discharged drilling muds; toxic effects of muds in marine and estuarine life forms, and changes in population levels in benthic communities following the discharge of various levels of drilling muds.

Raised by: U.S. Fish and Wildlife Service

Response: The BLM Environmental Studies Program has initiated investigations on the impacts of exploration activities locally near drilling rigs. In April to June, 1976, the State University System, Institutes of Oceanography in Florida, under contract to BLM, monitored an exploration site in the Gulf of Mexico before, during, and after drilling. Mud disposal and rig emplacement are the primary impact-producing activities being investigated, with benthic sampling for sediments and biota being the most significant component of the effort. Community description and analysis of changes is performed, as well as hydrocarbons and trace metal analyses on both sediments and biota. Results from the first rig monitoring effort have not yet been completed; the second rig monitoring study, to be conducted by the University of Texas and Texas A&M under contract to BLM, is scheduled for September, 1976.

Issue No. D-2: More information is needed on all aspects of the environment but BLM is committed to only a vague "baseline and special studies program", specific federal guidelines should be developed giving the level of information that must be provided for an EIS to be acceptable.

Raised by: Dept. of Commerce

Response: In response to the comment that "BLM, however, is committed only to a vague 'baseline and special studies program,' with no particular level of effort or results required. Specific federal guidelines should be developed giving the level of information that must be provided for an environmental statement to be acceptable," it should be noted that such guidelines were prepared and reported to the Outer Continental Shelf Research Management Advisory Board by NOAA Scientific and Technical Committee on Marine Environmental Assessment in November, 1974. These guidelines have recently been revised and reissued, under the title "Guidelines for the Design and Conduct of OCS Oil and Gas Development Environmental Baseline Studies," February, 1976. Copies are available from the Chairman, Outer Continental Shelf Environmental Studies Advisory Committee. The level of effort expended in the completion of the various BLM OCS Baseline Studies is necessarily dependent upon the level of funding made available by Congress, on an annual basis.

Issue No. E-1: Army Corps of Engineers requirements for issuance of permits.

Raised by: U.S. Fish and Wildlife Service

Response: The section in question has been omitted because the jurisdiction of the U.S. Coast Guard in federal waters on the OCS are limited to navigation and consideration of national security.

Issue No. E-2: Some mention should be made of the Outer Continental Shelf Lands Act Amendments of 1976 that is under discussion by Congress.

Raised by: Texas Water Rights Commission, Department of Commerce

Response: A brief discussion of this pending legislation is included in Section IV.E.7.

Issue No. E-3: BLM Rational for Stipulations b and c.

Raised by: Department of Commerce, NOAA, NMFS, St. Petersburg, Florida. USDI, USFWS, Albuquerque, New Mexico USDI, USGS, Metairie, Louisiana, USGS, Reston, Va.

Response: The Bureau of Land Management believes that stipulations b and c adequately protects the integrity of the fishing industry and provides for a multi-use concept of the OCS. For stipulation b, the Supervisor will consult with BLM and USFWS concerning the development of mitigating or protective measures for each permit application either during the drilling activity, or placement of any fixed structure or pipeline. Additionally, NOAA-NMFS and other concerned agencies will be consulted by BLM and USFWS for input in the development of these measures. Secretarial Order No. 2974 outlines procedures for disposition of disagreements concerning review of permit applications between USGS, BLM, and USFWS.

In the environmental review process by BLM for iologically sensitive areas, bathymetric maps prepared by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey for BLM at a scale of 1:250,000 were inspected for fishing areas and reefs. Also fishing charts, additional bathymetry charts, and publications prepared by state and federal agencies, academic institutions, oil industry, and commercial organizations were reviewed. A partial list of these sources may be found in Elvers and Johnston (1976).

If unique biological features are identified after the lease sale, stipulation c provides for the protection of these areas following forementioned guidelines for stipulation b. If a concerned agency feels that additional information is needed for a particular block, the Supervisor can invoke regulation 30 CFR 250.34(a)4 and require submission with the exploration plan.

Issue No. E-4: The impacts of possible activities within the area that is regulated by the Corps of Engineers should be discussed.

Raised by: Dept. of the Army, New Orleans Corps of Engineers

Response: This information has been incorporated into Section IV.E.7.

Issue No. E-5: The stipulations on cultured resources should be changed, (see USGS letter).

Raised by: USGS, Reston, Va.

Response: The stipulation concerning cultural resources has been changed to recommendations from USGS (Section IV.E.1.b.).

Issue No. E-6: The stipulation for drilling or production, including pipelines should be changed, (see USGS, Reston, Va. letter).

Raised by: USGS, Reston, Va.

Response: This suggestion has been incorporated into Section IV.E.1.

Issue No. E-7: The stipulation dealing with pollution containment is a summary of OCS Order No. 7 and should be deleted.

Raised by: USGS, Reston, Va.

Response: This stipulation (d) has been deleted as suggested in Section IV.E.1.

Issue No. E-8: The stipulation should be applied to all tracts offered in the proposed lease sale. The stipulation concerning subsequently discovered fishing and hard banks should be revised.

Raised by: Dept. of Commerce

Response: Refer to the response on stipulations Issue No. E-3 Mitigating Measures.

## Issues Concerning Relationship Between Local and Short-Term Use and Maintenance and Enhancement of Long-Term Productivity

Issue No. A-1: The long-term vs. short-term productivity of OCS platforms should be discussed.

Raised by: U.S. Fish and Wildlife Service

Response: Long-term and short-term are somewhat relative expressions. We concur that the life of a constructed platform averages 10-30 years and have adjusted the wording in Section VI of the FEIS to more definitively indicate the time frame involved. The New Orleans OCS Office is planning to investigate the potential of extending the life of platforms, obsolete to industry but valuable to public or private interests.

## Issues Concerning Alternatives of the Proposed Action

Issue No. A-1: Quantitative estimates of national benefits that would result from the lease sale should be included.

Raised by: Dept. of Commerce

Response: Some consideration of national benefits have been treatd in the sections of the impact statement dealing with the alternatives to this action.

Other points dealing with national benefits are noted in the section dealing with the legal and administrative background for the proposal.

## Issued Concerning the Visual Graphics

Issue No. 1: Color shading on the lease status Visual No. 1 is incorrect.

Raised by: Department of Transportation, U.S. Coast Guard

Response: Galveston area, block A-144 is not listed in the tract list (Appendix A) to be offered for lease. The orange-brown rather than purple color on the lease status Visual No. 1 was a printing error.

Issue No. 2: Visual No. 2 for the General Gulf of Mexico, "Tropical Storms in the Gulf of Mexico and Atlantic Ocean 1954-1975" was not enclosed for our review.

Raised by: Dept. of the Army, New Orleans Corps of Engineers

Response: Visual No. 2 will be furnished with the FES No. 44.

Issue No. 3: In Visual No. 2 "Tropical Storms in the Gulf of Mexico and Atlantic Ocean," the term "tropical storms" should be replaced by "tropical cyclones".

Raised by: Dept. of Commerce

Response: The title for Visual No. 2 "Tropical Storms" will be corrected when this visual is reprinted.

United States Department of the Interior
BUREAU OF MINES
WASHINGTON, D.C. 20241

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July 1, 1976

Memorandum

To: Director, Bureau of Land Management
Attention: 732

Through: Deputy Assistant Secretary--Energy and Minerals

Ramon R. Gill
JUL 6 - 1976

From: Director, Bureau of Mines

Subject: Review of Environmental Impact Statement draft of the proposed 1976 Outer Continental Shelf (OCS) Oil and Gas Lease Sale (#44), Offshore Texas and Louisiana, Gulf of Mexico

In response to your request of June 12 we have reviewed the subject impact statement.

Comments are as follows:

Description of the Environment Section

Page 1, right column, first paragraph reads, "sandstone provides the reservoir into which hydrocarbons migrate." Sandstone is defined as highly cemented sand, hard and usually tight. Sand is defined as soft-to-firm and porous. We suggest the use of sand in connection with any reference to petroleum source beds.

Environmental Impact of Proposed Action Section

Page 9, right column, seventh line, The Bureau of Mines has not conducted oil seep studies in the Gulf of Mexico.

The Bureau wishes to commend the Bureau of Land Management for the preparation of this study.

Director

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United States Department of the Interior
BUREAU OF OUTDOOR RECREATION
SOUTH CENTRAL REGIONAL OFFICE
PATIO PLAZA, 5000 MARBLE N.E., ROOM 211
ALBUQUERQUE, NEW MEXICO 87110

IN REPLY REFER TO:

J 1976

Memorandum

To: Manager, New Orleans Outer Continental Shelf Office
Bureau of Land Management, New Orleans, Louisiana

From: Regional Director, Bureau of Outdoor Recreation

Subject: Draft Environmental Statement Concerning a Proposed Oil and Gas Lease Sale Offshore Texas and Louisiana

In accordance with the memorandum from the Director, Bureau of Land Management, of June 2, 1976, we have reviewed the subject draft environmental statement and have the following comments to offer.

In general we believe the statement adequately addresses the impacts of the proposed leasing and subsequent oil and gas exploration and production operations on recreation in the immediate vicinity. However, we believe that the statement should discuss and consider the Texas and Louisiana Statewide Comprehensive Outdoor Recreation Plans and their input into recreational planning for the affected areas. The States identify specific resources they feel are valuable and should be protected in those areas. The possible effects of the proposal on these resources should be coordinated with the State and this should be discussed in the environmental statement.

If we can be of any further assistance to you, please do not hesitate to contact us.

Rolland B. Handley
Rolland B. Handley

cc:
Division of Minerals Environmental
Assessment (732)
Bureau of Land Management
Washington, D. C. 20240

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DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P O BOX 1229
GALVESTON, TEXAS 77553

REPLY TO
ATTENTION OF:
SWGED-E

13 JUL 1976

Manager
New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
Suite 841, 500 Camp Street
New Orleans, Louisiana 70130

Dear Sir:

This is in response to a letter from Mr. Frank A. Edwards, Director, U.S. Department of the Interior, Bureau of Land Management, Washington, D.C. 20240, dated 2 June 1976, submitting the draft environmental statement concerning a proposed Outer Continental Shelf oil and gas general lease sale for our review and comments.

The land surface subsidence map shown on page 5 is obsolete with the extent of the area affected by subsidence being considerably greater than indicated. A more recent map was published in 1973 showing subsidence in the Houston-Galveston area in the U.S.G.S. report titled "Land-Surface Subsidence in the Houston-Galveston Region, Texas," by R. K. Gabrysch and C. W. Bonnet.

It is suggested that under the heading "Barrier Islands" on page 41, St. Joseph Island be added.

Sincerely yours,

Jon C. Vanden Bosch
JON C. VANDEN BOSCH
Colonel, Corps of Engineers
District Engineer

Copy furnished:
Director
Department of the Interior
Bureau of Land Mgmt
Washington, D.C. 20240

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DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT CORPS OF ENGINEERS
P O BOX 60267
NEW ORLEANS LOUISIANA 70160

RECEIVED
AUG 3 8 56 AM '76
BUR OF LAND MGMT.
OUTER CONTINENTAL
SHELF OFFICE
NEW ORLEANS LA.

IN REPLY REFER TO
LMNPD-RE

Manager
New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
Suite 841
500 Camp Street
New Orleans, Louisiana 70130

Dear Sir:

Your draft environmental statement (EIS) with cover letter dated 2 June 1976, concerning a proposed Outer Continental Shelf (OCS) oil and gas general lease sale was referred to this office from our Washington office for comment.

We have reviewed the EIS in accordance with our areas of responsibility and expertise as outlined in the Council on Environmental Quality guidelines, Title 40 CFR, Part 1500, published in the Federal Register dated 1 August 1973, and US Army Corps of Engineers administrative procedures for permit activities in navigable waters or ocean waters, Title 33, CFR, Part 209, published in the Federal Register dated 25 July 1975.

In the administration of navigation laws, the Corps is charged with requiring permits for all work or structures in navigable waters of the United States, for deposits of dredged or fill material in navigable waters, and for the transportation of dredged material for dumping in ocean waters. Permits to install islands and fixed structures and the drilling of wells from mobile drilling vessels must also be obtained from the Corps, which is authorized by the OCS Lands Act to prevent obstruction to navigation. On the OCS, the Corps considers only navigation and national security in the evaluation of permit applications involving lands under mineral leases from the US Department of the Interior. For work and structures within the waters of the sovereign states, the scope of evaluation assigned to the Corps in permit actions

LMNPD-RE
Manager, New Orleans OCS Office 2 August 1976

is significantly expanded. The decision as to whether a permit will be issued by the Corps is based on an evaluation of the probable impact of the proposed work on the public interest. All factors which may be relevant to the proposal are considered; among those are national security, conservation, economics, esthetics, general environmental concerns, historic values, fish and wildlife values, flood damage prevention, land use classification, navigation, recreation, water supply, water quality, and in general, the needs and welfare of the people. Pipeline construction must also be in compliance with standards established by the Office of Pipeline Safety, US Department of Transportation. The US Department of Labor establishes Occupational Safety and Health Standards which are applicable to OCS operations.

Our review of the draft statement in accordance with our administration of navigation laws as they apply to activities on the OCS, indicates that the statement is generally adequate in its assessment of the impacts of the proposed action. Our review of the statement from the public interest review standpoint as required for regulatory permit activities within the waters of the sovereign states discloses however, that the EIS does not adequately assess the impacts of possible activities within these waters. We realize that this statement was not intended to cover all possible activities which are a result of the proposed lease sale and subsequent drilling operations. We mention the inadequacy of the statement only to avoid misunderstandings regarding its application. Activities such as pipelines, onshore terminals, and associated appurtenances within the waters of the sovereign states will be dealt with individually and this EIS will not be considered in their evaluation.

We offer the following comments regarding the draft impact statement for your consideration:

a. Comments on Section II

(1) Page 16, Tropical Cyclones. A stage of 6 meters on Bayou Lafourche during Hurricane Betsy appears incorrect. This district's Hurricane Betsy Report indicates a stage of 5.4 ft. mean sea level at Leeville on Bayou Lafourche. The EIS should reference the source of this data more explicitly, so it could be checked.

(2) Page 18, Surface Circulation. The distribution of flow through Southwest and South Passes and Pass a Loutre is given as 15, 29, and 37 percent, respectively. The long-term average as determined by the New Orleans District (NOO) indicates flow through Southwest and South Passes and Pass a Loutre is 31.5, 17.0, and 31.5 percent, respectively.

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LMNPD-RE
Manager, New Orleans OCS Office 2 August 1976

(3) Page 40, Salt Marsh. According to Chabreck's (1972) map, saline marsh does not occur in the Mississippi delta. The 2 to 24 meter width of saline marsh noted in the EIS should be extracted.

(4) Page 81. The title of the referenced shoreline study should be changed to the more recent available version, National Shoreline Study Regional Inventory Reports, 1973. The EIS indicates more widespread beach-oriented recreational development in southwest Louisiana between Holly Beach and the Mermentau River than is indicated in the shoreline study. Development is localized at the extreme ends of this beach.

(5) Page 92. The last sentence of the first incomplete pargaraph should be revised as follows: The Inner Harbor Navigation (Industrial) Canal in the City of New Orleans connects the Mississippi River with Lake Pontchartrain, the Gulf Intracoastal Waterway east of New Orleans and the Mississippi River-Gulf Outlet ship channel.

(6) Page 117, Water Quality. The Corps no longer has authority to issue permits for industrial dischargers. This authority now belongs to the Environmental Protection Agency (EPA).

The vast majority of the water quality data collected by the NOO is available either as computer printouts in a well organized columnar listing or in tabulations used for internal reports.

The statement, "...through its Data Retrieval Program (RAPP)," refers to the original Corps permit program for industrial and municipal dischargers that was taken over by EPA. The RAPP is not related to EPA's data retrieval program.

(7) Pages 118 and 119. The relationship between the municipal and industrial effluents given in tables H-7 and H-8 and the baseline water quality conditions in coastal Louisiana is not readily apparent.

b. Comments on Section III

(1) Page 33. It is stated that the probability of a major oil spill resulting from this proposed sale is uncertain. This statement should be clarified.

(2) Page 58. The second paragraph should clarify why it is impossible to backfill canals and ditches. Backfilling is a desirable alternative currently utilized in Coastal Louisiana for reduction of environmental impacts where new land cuts are necessary.

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LMNPD-RE
Manager, New Orleans OCS Office 2 August 1976

c. Volume 3. Visual No. 2 for the General Gulf of Mexico "Tropical Storms in the Gulf of Mexico and Atlantic Ocean 1954-1975" was not inclosed for our review.

In accordance with guidelines of the President's Council on Environmental Quality, a copy of this letter is being forwarded to Mr. Timothy Atkeson, General Counsel of that body.

Thank you for the opportunity to review and comment on the draft environmental statement.

Sincerely yours,

LTC, CE
EARLY J. RUSH III
Colonel, CE
District Engineer

Since the comments for the DES for Sale No. 44 were received after the requested due date, a complete response concerning each issue has not been included in the FEIS. However, where possible every effort has been made to respond to the comments and incorporate changes in the text to reflect the information that was furnished.

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Duval Building
9450 Gandy Boulevard
St. Petersburg, Fl 33702

RECEIVED
BUR OF LAND MGMT.
OUTER CONTINENTAL
SHELF OFFICE
NEW ORLEANS, LA.

April 23, 1976 FSE21/RT

Mr. John L. Rankin
Bureau of Land Management
Outer Continental Shelf Office
Suite 3200, The Plaza Tower
1001 Howard Avenue
New Orleans, LA 70113

Dear Mr. Rankin:

This is in response to your April 6, 1976, letters to Messrs. Richard J. Hoogland and Donald Moore of my staff requesting their review and comments on the Bureau of Land Management (BLM) proposed stipulations for Outer Continental Shelf (OCS) Sale #44.

Since proposed stipulation 1(a) concerns archaeological resources for which we are not responsible, our review was limited to proposed stipulations 1(b) and (c).

Regarding stipulation 1(b), we are concerned that lessees of only tracts 10, 11 and 61, which are known to contain fishing or hard banks, would be required to provide a bathymetric map with an interpretation as to the presence and location (or absence) of hard biological communities prior to any drilling activity, and a log of materials introduced into the marine environment during the exploratory and development phases. As discussed at the January 22, 1976, interagency meeting in Galveston, there are many areas in the Gulf where information on unique biological features is insufficient, including the other tracts in Sale #44. We, therefore, recommend that Stipulation 1(b) be required for all tracts. As such, for each tract to be developed, the lessee should provide a detailed bathymetric survey (scale to 2 meters) and a general narrative description of the bottom features to the concerned Federal agencies, including National Marine Fisheries Service.

We are also concerned that Stipulation 1(b) does not address protective measures discussed at the January 22 meeting. We, therefore, recommend the following stipulations for leases issued in any tract containing presently known, or subsequently discovered, fishing banks or hard banks:

1. Drilling sites and pipeline routes shall be located to avoid fishing banks or physical interference with commercial and sport fishing activities. If a well site is to be located within 3 miles of a fishing bank, shunting of drill cuttings to an appropriate depth may be required.

2. No bulk dumping of drilling muds shall be conducted within 10 miles of any fishing bank.

3. To maintain the integrity of a small fishing bank (generally 1,000 acres or less) and its accessibility to sport and commercial fishermen, no drilling shall be conducted on the top or slope of any such bank.

In our opinion, it is appropriate to apply these stipulations to tracts subsequently found to contain unique habitats since Section 250.12(b) of the Regulations Pertaining to Mineral Leasing, Operations and Pipelines on The Outer Continental Shelf (30 CFR 250) provides for the supervisor to prescribe departures from the lease agreement when such departures are necessary for the "conservation of natural resources, protection of aquatic life, protection of human health and safety, property, or the environment."

We further request that the NMFS Regional Director be included in the Geological Survey Supervisor's consultation mentioned in your proposed stipulation 1(b) since under Reorganization Plan No. 4 of 1970 (35 Fed. Reg. 15627, 84 Stat. 2090) and related laws, the National Oceanic and Atmospheric Administration (NOAA) is vested with a major responsibility for participation in matters relating to the marine and estuarine area. With respect to fisheries, the NOAA responsibility is carried out by NMFS.

Stipulation 1(c) states that structures and pipelines should be kept to a minimum so as not to interfere with other significant uses of the OCS, including commercial fishing. We recommend that this stipulation also indicate that the Regional Director, NMFS, shall be consulted to aid in determining present and potential use of an area by the commercial fishing industry. The supervisor's review of the necessity of structures and alternatives to proposed placement should also consider the method of installing pipelines. Further, a stipulation providing that pipelines and submerged wellheads would normally be installed beneath the seafloor in areas where commercial trawl fisheries exist should be included.

We appreciate the opportunity to provide these comments.

Sincerely,

William H. Stevenson
Regional Director

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UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

July 22, 1976

Mr. John L. Rankin, Manager
New Orleans Outer Continental Shelf Office
Bureau of Land Management
Department of the Interior
Hale Boggs Federal Building
500 Camp Street - Suite 841
New Orleans, Louisiana 70130

Dear Mr. Rankin:

The draft environmental impact statement, "Proposed 1976 Outer Continental Shelf Oil and Gas Lease Sale, Gulf of Mexico," has been received by the Department of Commerce for review and comment. The statement has been reviewed and the following comments are offered for your consideration.

General Comments

The document is generally well-organized and well written. It includes a relatively complete picture of existing environmental conditions in the geographical areas in consideration. It also provides a satisfactory assessment of the types of ecological situations that are likely to develop in the impact area due to drilling for oil and gas.

The overall quality of the sections of the draft impact statement dealing with economic impacts, however, is poor. The economic discussions are developed from basic assumptions which appear incomplete and which may be invalid.

The sections of the draft environmental statement dealing with physical oceanography and meteorology are inadequate, largely because they do not include the BLM-funded National Ocean Survey study of the physical oceanography of the South Texas lease area. This report utilized historical data and was submitted to BLM in draft form in February 1976. The final environmental statement should incorporate the results of this study.

Sections II.B. Climate and II.C. Physical Oceanography consist mostly of excerpts of general analyses of the Gulf of Mexico region prepared 10-20 years ago. Those do not focus on the continental shelf, are too general, and contain numerous inaccuracies. Under no circumstances should this level of effort be considered adequate for an environmental statement. The final environmental statement for any area should always include at least an analysis of historical data, and should clearly identify information gaps to be filled in with future studies.

Much of the material dealing with impacts is of questionable usefulness because not enough site-specific physical information is used. Although currents are poorly understood, general wind patterns are known and should have been utilized in the spill spreading discussion (Section III.B.) and the matrix analysis (Section III.M.).

What is most clear from this document is that much more information is needed on all aspects of the environment. BLM, however, is committed only to a vague "baseline and special studies program," with no particular level of effort or results required. Specific federal guidelines should be developed giving the level of information that must be provided for an environmental statement to be acceptable.

The statement describes briefly the national Coastal Zone Management program, and the federal consistency provisions. Presently included are licenses and permits; leases are not mentioned within the Coastal Zone Management Act of 1972.

Amendments to the Act (S. 586, H.R. 3981) have recently been reported out of the conference committee. The amendments establish a new Section 307(c)(3)(B), which requires that any person submitting an exploration or development plan for OCS activity attach a certification that each activity detailed will be effected in a manner consistent with approved state programs.

Because this bill is not yet law, and neither Texas nor Louisiana have approved Coastal Zone Management programs, this section may not be pertinent to consideration of this lease sale. Nevertheless, the potential need for such certifications makes it highly advisable for the Bureau of Land Management to consult with the various state Coastal Zone Management agencies. The appropriate agencies for this sale are the Louisiana State Planning Office and the Texas General Land Office.

In Chapter II, "Description of the Environment," the ocean environment is described in terms of surface currents, tides, waves, temperature, and salinity. The discussion of temperature and salinity, however, is very limited. General patterns of surface values are discussed, but the vertical structures are not mentioned. Also, there are no summaries of existing data, which would be useful to indicate expected values and ranges both at the surface and within the water column. There is no discussion of water density and its vertical structure, which can have a major impact on the fate of spilled oil.

Bottom sediments and sediment loadings are adequately covered in the statement, but suspended sediment burdens in the water column are not. Considering the important role suspended sediments are known to play in the movement of spilled petroleum through the water column, the characteristics of suspended sediments in the impact area should be described in detail in the final statement.

The statement does not provide information about vertical temperature, salinity and density structures in the study area. The statement also does not include descriptions of horizontal density and salinity distributions in the impact area. This information should be presented in the final statement.

The statement does not provide a description of the seasonal variability of the Loop current. This information, together with a description of the eddies that are generally associated with the Loop current, should be included in the final statement.

The statement contains no information about the speed of tidal currents in the impact area. That information, including calculation of the 100-year wave and storm surge, should be included in the final statement.

All scientific names of plants and animals mentioned in the statement should be checked for accuracy in regard to spelling and taxonomy, and should be either underlined or set in italics in the final statement. A number of scientific names of organisms are presented incorrectly in the draft statement.

It is assumed in the statement that the oil produced through the lease action in question will only replace depleting domestic supplies of crude oil, and that the action will not result in significant growth of local economies and populations. These

assumptions may be incorrect. It is possible that much more oil will be discovered in the lease area than is anticipated. Increasing levels of population density and economic activity could develop in the impact area because of this, as well as for a variety of other reasons relating directly to the lease. The economic and environmental impacts of these alternative growth scenarios should be considered fully in the final statement. If sound reasons exist for not considering growth scenarios, the reasons must be stated and justified in the final statement.

It is assumed without justification in the statement that the locally adverse social and economic impacts that could result from oil spills are of a low magnitude. The assumption remains incomplete and inconclusive until presented in a context that permits estimation of degrees of potential impacts of oil spills. The assumption should be supported by estimates of economic parameters such as net dollar costs of damage by spilled oil to commercial fisheries and coastal land resources.

Quantitative estimates of national benefits that would result from the lease are not included in the statement. Such estimates are required components of environmental impact statements, and should be presented where appropriate in the final statement.

The reasons for selecting the tracts under consideration for lease are not discussed in the statement. Why these areas were chosen rather than other sections of the Gulf Coast should be outlined in detail in the final statement. The discussion should consider the magnitude of petroleum resources available in different areas of the coast. It should also offer a general comparison of the magnitudes of environmental and economic impacts to different coastal areas that could result from exploitation of petroleum reserves.

The coverage of background information presented in the statement by way of referencing is excellent. We applaud in particular the practice of making reference to previous environmental impact statements for supplementary information.

## Specific Comments

Volume 1

II. DESCRIPTION OF THE ENVIRONMENT
E. Biological Oceanography
3. Nekton

Page 18. The statement that "The western half of the Gulf has no strong semipermanent currents but is characterized by a well-defined pattern of winter flow and a highly variable summer pattern," seems to contradict another statement made on the same page that "after sweeping westward along the Louisiana continental shelf prevailing surface currents turn southwestward roughly paralleling the Texas Coast....current velocities range in speed from about 0.7 to 2.8 km/hr." Because of this ambiguity, it is not clear whether or not strong semi-permanent currents exist in this region.

Page 31, paragraph 7. The sentence, "Data by James, et al (1972) ...deeper waters" is contradictory with regard to species diversity and abundance on the outer, intermediate, and inner shelf. This sentence should be clarified.

F. Biological Environment of the Coastal Zone

Page 40, paragraph 5. The last sentence of this paragraph should read, "The Mississippi contributes nutrients to most of the estuaries in Louisiana..."

1. Salt Marsh

Page 40, paragraph 11. This paragraph is confusing and should be clarified.

G. Human Utilization

3. Recreation and Allied Resources

a. Sport Fishing

Pages 60, 61, and 71; tables G-4, G-5, and G-11. The unit of measure for the weight of fish caught should be included in the three tables.

5. Commercial Fishery Resources

Page 103, paragraph 6. In the ranking of the most important commercial fishes by value, "croaker" has been listed twice.

III. ENVIRONMENTAL IMPACT OF THE PROPOSED SALE

A. Basic Assumptions Regarding Causes of Impacts of the Proposed Action

1. Disposal of Drill Cuttings and Commercial Muds

Page 9, paragraph 4. An apparent arithmetical error is included in the statement "During 1973 approximately 1,404 billion tons (10 billion barrels) of oil were transported by tankers:"

Page 1, paragraph 6. This section should note that it is not uncommon for drilling muds to be discharged into the marine environment in bulk whenever these muds are no longer suited for re-use or whenever the well has been completed and it is not considered economical to return the muds to shore. This practice is alluded to on page 50, paragraph 10 of this section wherein it is stated that, "Drilling muds that are used during drilling operations will be discharged periodically into the Gulf."

Page 1, paragraph 10. The first sentence of this paragraph states that "use of chrome materials, oil and other toxic materials in the Gulf offshore mud systems has been avoided for several years." The last sentence, however, indicates that, "Barium sulfate and chromium lignosulfate are commonly used compounds found in offshore drilling mud programs in the Gulf of Mexico OCS." This apparent contradiction should be clarified.

3. Disruption of Sea Floor and Resuspension of Sediments During Pipeline Burial

Page 7, paragraph 2. This paragraph states that pipeline burial may not be required in water deeper than 60 meters. Similar statements are made on pages 32, 34, 35, and 37 of Section III and on page 1 of Section IV. These statements contradict statements on page 46 (Pipelines) of Section III, which indicate that pipeline burial will be required out to a water depth of 81 meters. This discrepancy should be corrected in the final statement. If 81 meters is correct, this would ensure pipeline burial on most of the presently trawled brown shrimp grounds. However, if pipeline burial is still only required to the 60meter depth contour, the comments made by the National Marine Fisheries Service, in their April 14 and 23, 1976, letters to the Manager, New Orleans Outer Continental Shelf Office of BLM should be thoroughly discussed. These letters include comments regarding the conflict between unburied pipelines and commercial fishing in waters from 200 to 300 feet deep.

5. Probability of Accidental Oil Spills in the Gulf of Mexico
a. Pipeline Accidents

Page 7, paragraph 6. This paragraph should reference Figure A-1, page 8, which indicates that pipeline accidents resulting from pipelines being severed by ships' anchors have caused the release of the greatest quantity of oil into the world's oceans. In addition, this paragraph should note that unburied pipelines would be more likely to be damaged by ships' anchors.

B. Impact on the Living Components of the Environment: The Gulf of Mexico and Coastal Zone Regions

5. Impact on Biologically Sensitive Areas
b. Reefal Features

Pages 14, 18, and 20. Sea surface currents in this area are not weak and variable and are not clearly determined by the wind. The notion of a seasonally shifting "convergency zone" is misleading and oversimplified. Given the strong seasonal variations in most of this region, yearly summaries such as that given in visual aid 6 are not useful. Figure C-2 (page 20) should not be extrapolated to the shelf, and is of limited accuracy in the open Gulf.

Page 14. Near-coast winds in this region are not more variable than open water winds due to moving cyclonic storms. Rainfall is light end not at all evenly distributed along the South Texas coast. Maximum amounts occur in September.

Pages 14-15. July mean air temperatures show little increase coastward from the central Gulf; the coast-to-mid Gulf difference in no case approaches 3° C. The January water temperature means in Figure B-1 (page 15) and the discussion on pages 18-22 fail to show the substantial winter temperature gradient over the continental shelf.

Pages 15-18. We are not satisfied that the likelihood of platform collapse and well blowout is as low as assessed and will withstand criticism. The logic is hard to retrace by citation because of nonsequential pagination and lack of outline subheadings in the text. There are other flaws in the presentation. The underlying CEQ (1974) report repeatedly cited in text doesn't appear in the bibliography. It may be the MIT (1974) report for CEQ that is in the bibliography. The important citation of McGowan, et al (1970) appears to be the McGovern, et al (1970) item in the bibliography.

Page 15. The analysis critically depends on the assumption that the probability of the natural event occurring (storm and attendant forces) is adequately described by recurrence relationships. No evidence is given that these are available for the Gulf of Mexico. Pending thorough research, we tend to agree with the contrary caveats presented on page 117 of Section IIH2 and page 1, Section III. We have seen part of the necessary material for up to 50 year design lives, but by no means all of it for 100 and 200 year lives, as required by the assumptions.

Page 16. A probability of 1 in 6, as cited, is acceptable in reference to a tropical storm strike on a 50-mile coast segment. It is approximately valid for a 50 by 50 mile area offshore in the lease locality. It is closer to 1 in 2 for an offshore area 2½ degrees latitude locality. It is closer to 1 in 2 for an offshore area 2½ degrees latitude square. The data imply a probability of from .81 to .996 that any one platform will experience a tropical storm center passing within 25 miles over a 20 to 40 year field life. We do not have such quantitative data on the probability of destructive wind and sea forces given that this event occurs. If it were available and design were successful as assumed in the statement, the probability of collapse and blowout for any one platform would tend to be low and governed by subsurface valve reliability as stated. The analysis fails to note that if such a destructive storm occurs, it would affect not just one but potentially tens to hundreds of lease sites and potential platforms. Thus, the probability of at least one blowout resulting from storms over the whole area and field life seems necessarily one or two orders of magnitude above those stated in Table A-6 and associated conclusions.

While we have not worked out complete quantitative details, we think the statement is vulnerable on this point.

Page 26. Spatial and temporal salinity gradients are substantial over the shelf, making surface salinities for a single cruise of little use.

Page 40, paragraph 3. There are many areas in the Gulf of Mexico, including tracts other than 10, 11, and 61 of this sale, where information on unique biological features is insufficient. It is unlikely, therefore, that requiring only the special stipulations listed in "Mitigating Measures Included in the Proposed Sale," would provide protection from adverse impacts associated with petroleum exploration and production for tracts which might subsequently be discovered to contain fishing or hard banks. The special stipulation applied to tracts 10, 11, and 61 should, therefore, be applied to all tracts in this lease sale.

9. Impact on Commercial Fisheries

Page 43, paragraph 6. The last sentence of this paragraph is incomplete.

a. Removal of Sea Floor From Use

Page 43, paragraph 7. Areas around unburied pipelines should be included in the list of sea floor areas which must be avoided by commercial fishermen using trawls. Also, as indicated in the latest "Gulf Coast Shrimp Data, Annual Summary," trawlers are presently fishing for brown shrimp in depths to and beyond 91 meters. Trawling for royal red shrimp occurs in deeper waters off the Mississippi River delta. Trawling, therefore, is not limited to within the 82-meter depth as indicated in this paragraph. This information should be corrected in the final statement.

Page 44, paragraph 3. A recent study, investigating the effects of offshore petroleum platforms on the commercial availability of demersal fishery resources in the North Central Gulf of Mexico, indicates that offshore explorations could cause a decline in shrimp catches.[1] Although the abundance by weight of crustaceans and other invertebrates increased as platform densities increased up to two to three platforms per 269 $km^2$ (more than 100 square statute miles), greater platform densities resulted in a marked decline of the catch per unit of effort. This suggests that fisheries such as shrimp may be adversely affected by a high density of platforms. During the preparation of operating orders for the proposed lease areas and during the review of plans for exploration and development, constructing platforms in areas of high shrimping effort should be avoided.

b. Underwater Obstructions

Page 44, paragraph 4. The list of underwater obstructions listed in this paragraph should also include unburied pipelines since they may also present a hazard to trawls and nets.

Page 44, paragraph 8. This section should note the existence (and number) of trawl "hangs" in the following tracts covered by this sale: 1, 2, 5, 14, 15, 16, 11, 18, 20, 25, 33, 35, 42, 43, 45, 46, 47, 52, and 53.[2] Also, Stipulation C (Mitigation Measures Included in the Proposed Action Selection) concerns only the limiting of structures and does not mention other bottom fishing obstructions. The possibility of locating submerged well heads and/or emergent platforms alongside previously located bottom fishing obstructions, so new "hangs" for shrimp and fish trawls are not created, should be thoroughly discussed and considered for adoption.

d. Pipelines

Page 46, paragraph 5. This paragraph states that, "BLM, through its permit authority, requires pipelines to be buried a minimum of one meter out to a water depth of 81 meters." This contradicts statements made previously in the statement which indicate that BLM requires pipeline burial in water depths less than 61 meters. If pipeline burial is presently required out to the 81 meter depth contour, the likelihood of trawl damage by unburied pipelines would be reduced, especially since current trawl fisheries are not well developed beyond the 270-ft. contour. The final statement, however, should note that since the trawl fishery is rapidly developing beyond the 270-ft. contour, it may become necessary in the future to bury pipelines out to the 300-ft. contour.

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[1] Massey, L.L. Effects of offshore petroleum platforms on the availability of demersal fishery resources in the North Central Gulf of Mexico. In Press.

[2] Graham, G.L. 1975. Bottom fishing obstructions: Texas/Louisiana Gulf. Marine Advisory Service: Fisheries, Texas A&M University. TAMU-SG-76-502.

Page 47, paragraph 1. This paragraph should also discuss the probable damage to the estuary resulting from canal construction.

K. Impact on Sport Fishing and Recreational Boating

Page 58, paragraph 11. The final statement should note that permanent platforms located near the top or slopes of small banks or reefs would reduce the fishermen's accessibility to the natural systems. Platforms may also recruit marine animals from the reef, thereby reducing the natural reef's potential as a fishing bank.

Tables. Table numbers A-8 and A-9 appear to be interchanged between their citation on page 18, Section III, of text and subsequent appearance. Table A-6 lacks column headings identifying field life. It appears theoretically consistent with some question as to whether quantification is complete and valid for the Gulf of Mexico. Notes to Table A-9 are incompletely cited and so not clear. We tentatively conclude the analysis is based on storm forces in the North Sea.

IV. MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION

C. Pipelines
1. Existing Responsibilities

Page 9, paragraph 6. This paragraph should indicate that the Corps of Engineers regulations, 33 CFR 209.120(g)(9); (40 FR 31329), state that, "..., the decision whether to issue a permit on lands which are under mineral lease from the Department of the Interior will be limited to an evaluation of the impact of the proposed work on navigation and national security." The final statement should also note that even though the National Marine Fisheries Service (NMFS) coordinates with the Fish and Wildlife Service (FWS) when reviewing Corps of Engineers permit applications, NMFS comments are normally submitted directly to the Corps.

E. Other Mitigatory Measures
1. Special Stipulations

Pages 13 and 14, paragraph 6. There are many areas in the Gulf of Mexico where information on unique biological features is insufficient, including tracts other than 10, 11, and 61. We recommend that the stipulation to be applied to tracts 10, 11, and 61 also be applied to all other tracts offered in this lease sale.

Page 14, paragraph 1. This paragraph should discuss the advisability of applying the following three stipulations for leases issued in any tract containing presently known or subsequently discovered, fishing or hard banks:

1. If a well site is to be located within 3 miles of a fishing bank, shunting or drill cuttings to an appropriate depth may be required.
2. No bulk dumping of drilling muds shall be conducted within 10 miles of any fishing bank.
3. To maintain the integrity of a small fishing bank (generally 1,000 acres or less) and its accessibility to sport and commercial fishermen, no drilling shall be conducted on the top or slope of any such bank.

VISUALS

In visual No. 2, "Tropical storms in the Gulf of Mexico and Atlantic Ocean," the term "tropical storms" should be replaced by "tropical cyclones." The latter term refers to both tropical storms (windspeeds between 34 and 63 knots) and hurricanes (windspeeds greater than 63 knots). These are the storms depicted in this visual.

Oceanographic data may be obtained from the National Oceanographic Data Center, EDS/NOAA, Washington, D. C. 20235.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving twelve (12) copies of the final statement. It is further requested that one copy of the final statement be sent directly to the Area Supervisor, National Marine Fisheries Service, Environmental Assessment Division, 4700 Avenue U, Galveston, Texas 77550.

Sincerely,

Sidney R. Galler
Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

RECEIVED
JUL 12 3 51 PM '76

cc: Mr. Frank A. Edwards, Director
Bureau of Land Management
Department of the Interior
Washington, D. C. 20240

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DEPARTMENT OF TRANSPORTATION
MATERIALS TRANSPORTATION BUREAU
WASHINGTON, D.C. 20590

JUL 16 1976

Mr. John Rankin
Manager, New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building, Suite 841
500 Camp Street
New Orleans, LA 70130

Dear Mr. Rankin:

The Office of Pipeline Safety Operations (OPSO) in the Materials Transportation Bureau has reviewed the draft environmental statement concerning a proposed Outer Continental Shelf oil and gas general lease (OCS Sale No. 44) of 61 drainage and development tracts of submerged lands offshore Louisiana and Texas.

OPSO has limited its review to pipeline facilities, and we have the following comment for your consideration for inclusion in the final environmental statement:

> On page 6 of Part I, "Description of Proposal," and pages 8 and 16 of Par. IV, "Mitigating Measures Included in the Proposed Action," of the draft environmental statement, Volume 1 of 3, please correct to read, the Office of Pipeline Safety Operations in the Materials Transportation Bureau instead of Office of Pipeline Safety. This is an updating in line with the reorganization of pipeline safety responsibilities in the Department. Also, on pages 1 and 4 of the section "Mitigating Measures Included in the Proposed Action," it should be mentioned that certain oil spills from pipelines are required to be reported to the Office of Pipeline Safety Operations (49 CFR Part 195, Subpart B).

If we can be of any further assistance in this matter, please let us know.

Sincerely,

for
Cesar DeLeon
Acting Director
Office of Pipeline
Safety Operations

cc: Director, Bureau of Land
Mangement, DOI

---

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. COAST GUARD (G-WS/73)
WASHINGTON, D.C. 20590
PHONE: (202) 426-2262

RECEIVED
JUL 27 8 40 AM '76
BU. OF LAND MGMT.
OUTER CONTINENTAL
SHELF OFFICE
NEW ORLEANS, LA

22 JUL 1976

Manager, New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
Suite 841, 500 Camp Street
New Orleans, Louisiana 70130

Dear Sir:

This is in response to a letter dated 2 June 1976 from the Director of the Bureau of Land Management to the Department of Transportation Water Resources Coordinator concerning a draft environmental impact statement for OCS lease sale for 61 tracts offshore Louisiana and Texas.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted. The Coast Guard had the following comments to offer:

"Vol 1, "Description of Proposal", page 7: The Seadock Deepwater port is located in South Brazos area blocks 430 and 459 and Galveston area blocks 429 and 460. The closest block in the proposed sale to Seadock is Galveston area block A-144 which is approximately 20 miles south of Seadock and only 1.5 miles from the proposed safety fairway.

"Vol 3, "Western Gulf of Mexico, Lease Status" chart: Galveston area block A-144 is not shaded purple to indicate it is a part of the proposed sale and Brazos South Addition area block A-144 and High Island East area block A-228 are both shaded orange-brown rather than purple."

The Department of Transportation has no other comments to offer nor do we have any objection to this project. The final statement, however, should address the concern of the Coast Guard.

The opportunity to review this draft statement is appreciated.

Sincerely,

D. J. RILEY
Captain, U. S. Coast Guard
Deputy Chief, Office of Marine
Environment and Systems
By direction of the Commandant

Copy to: Department of the Interior
Bureau of Land Management

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
WASHINGTON, D.C. 20545

JUL 26 1976

Manager
New Orleans OSC Office
U.S. Department of the Interior
Bureau of Land Management
Hale Boggs Federal Building, Suite 841
500 Camp Street
New Orleans, Louisiana 70130

Dear Sir:

This is in response to your transmittal dated June 2, 1976, in which you invited the Energy Research and Development Administration (ERDA) to review and comment on the United States Department of the Interior, Bureau of Land Management (USDI/BLM) draft environmental statement concerning a proposed outer continental shelf oil and gas general lease sale, OSC Sale No. 44.

It is possible that the planned exploration activities could impact on ERDA's planned oceanographic research programs in the offshore areas of the Mississippi Delta and South Texas. We request that we receive advance notification in writing of any activity associated with the proposed action that could damage moored instrumentation or would substantially alter environments under study in our programs.

The statement addresses the physical environmental impacts onshore and in the gulf area quite accurately, but does not discuss in depth the social and economic impacts due to the energy development. A description of the area, including recreation, transportation, historical archeological features, and land use as it exists to date is provided, but potential impacts after development are not addressed.

One cannot determine if employment will be drawn from the surrounding area, or if migration into the area will be necessary; will there be adequate housing during construction for any personnel who choose to locate in the area; where will the onshore base be located; are there adequate general service facilities; etc. The statement would be greatly improved if these and other secondary impacts were addressed which would provide the reviewer with a better overall assessment of both the negative and positive impacts due to the siting of this facility.

- 2 -

We have enclosed additional comments which you may wish to consider in the preparation of the final statement. These comments are directed to the nuclear energy alternative discussion.

Thank you for the opportunity to review and provide comments on this statement.

Sincerely,

W. H. Pennington, Director
Office of NEPA Coordination

Enclosure:
ERDA Staff Comments

cc: CEQ (5)

---

ERDA Staff Comments on the USDI/BLM Draft Environmental Statement for the Proposed Outer Continental Shelf Oil & Gas Lease Sale--Gulf of Mexico, OCS Sale No. 44.

PART VIII Alternatives to the Proposed Action: Nuclear Energy

P. 5, column 1, para. 2

We suggest that the first two sentences be adjusted to read:

> As of June 1, 1976, 58 nuclear plants with a capacity of 40,317 MW were licensed to operate. At the end of 1975, nuclear power generated about 9 percent of the Nation's electricity. . . .

P. 5, column 1, para. 5

This paragraph gives the impression that the measures taken to prevent harmful releases of radioactive material from light water reactor nuclear power plants are of questionable effectiveness. This is incorrect. It is suggested that the paragraph be revised to read:

> "Some airborne and liquid radioactive materials are released to the environment during normal operation. The amounts released are very small and potential exposure has been shown to be less than the average level of natural radiation exposure. The plants are designed and operated in such a way that the probability of harmful radioactivity releases from accidents is very low."

P. 5, column 2, table at bottom of page

It is suggested that this table be replaced with one from a more recent source. The following table is extracted from table 6.3, pp. 6-7, of the Nuclear Energy Center Site Survey - 1975, Part III, NECSS-75, USNRC, January 1976.

Annual Radioactive Emissions
[for a 1200 MW LWR]

| | BWR (Curies) | PWR (Curies) |
|---|---|---|
| Gaseous Release | | |
| Tritium | 43 | 1100 |
| Carbon-14 | 9 | 8 |
| Iodine | .4 | .19 |
| Noble Gases | 6200 | 4000 |
| Liquid Release | | |
| Tritium | 24 | 820 |

P. 11, Table B-1

> Electrical equivalents should be measured in "Megawatts of capacity," not "thousands of megawatts of capacity," as it now reads.

---

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

1 AUG

RECEIVED

Mr. Curtis J. Berklund
Director, Bureau of Land Management
(ATTN: 720)
U.S. Department of the Interior
Washington, D.C. 20240

Dear Mr. Berklund:

The Environmental Protection Agency, pursuant to its responsibilities under the National Environmental Policy Act and Section 309 of the Clean Air Act, has reviewed the draft environmental impact statement (EIS) for the Proposed 1976 Outer Continental Shelf Oil and Gas Lease Sale, Gulf of Mexico (OCS #44). EPA's detailed comments and recommendations are transmitted as Enclosure 1. The nature of our comments have led us to categorize the EIS as "ER-2", a category which indicates EPA has "environmental reservations" concerning the project, and believes the information contained in the EIS to be, in certain aspects, insufficient. A copy of EPA's rating system constitutes Enclosure 2.

EPA's detailed comments (see Enclosure 1) raise several issues, most of which have been discussed in relation to previous sales. One recurring issue pertains to the inclusion of barite and biocides in drilling muds, and the possible adverse effects that the discharge of these pollutants could have on the marine environment. Although we are not now prepared to recommend either for or against the continuing use of these constituents in drilling mud, our detailed comments indicate specific directions for further research into these very important issues.

EPA also believes that the oil spill response section and the description of the onshore effects of oil and gas production should be more thoroughly analyzed. With regard to the onshore effects, we reiterate our concern for the development of thorough and timely analysis of these secondary onshore impacts, as expressed in our 1 July 1976 letter to Mr. Alan Powers regarding State involvement in development decisions under proposed OCS Order #15. The information provided by the lessee under this proposed order may impact both the Areawide Waste Treatment Management Plans (developed under Section 208 of the Federal Water Pollution Control Act) and the Coastal Zone Management Plans prepared by coastal States. EPA's or the State's new source permitting authority will also be involved. Onshore effects would seem particularly important in light of the deepwater ports which are being proposed for the Gulf area, and the necessary coordination of these facilities with OCS offshore and onshore operations.

We appreciate the opportunity to have reviewed the statement and hope that our comments will be of assistance in the preparation of the final statement.

Sincerely yours,

Rebecca W. Hanmer
Director
Office of Federal Activities

Enclosures

(1) EPA Comments on the Draft EIS for the Proposed 1976 Outer Continental Shelf Oil and Gas Lease Sale, Gulf of Mexico (#44)

(2) EPA's EIS Classification System

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EPA Comments on Draft Environmental Impact
Statement for the Proposed 1976 Outer
Continental Shelf Oil and Gas Lease Sale,
Gulf of Mexico (#44)

Drilling Muds

EPA is concerned over the inadequacy of research information on the effects of drilling mud components on marine biota. The proposed "baseline monitoring" program being sponsored by the Bureau of Land Management will not adequately assess these potential effects.

The draft estimates that ten percent of the drilling mud will be discharged into the marine environment during drilling operations. More accurate estimates should be made of total drilling mud discharges since barite and biocides are associated with this process. Preliminary research results (at EPA's Environmental Research Lab in Gulf Breeze, Florida) have indicated that shrimp ingest large quantities of barium sulfate and that pentachlorophenol, a biocide used in drilling fluids, is toxic to salt-water fishes and may affect the structure and diversity of biota in marine and estuarine communities.

While it is well known that fish are attracted to offshore rigs, little is known about the potential for accumulation by resident food chain organisms of barium, strontium, biocides or other drilled mud constituents. Research is needed to measure the effects of drilling mud discharges on fishes, crustaceans, and corals. Research is also needed to study the effects on humans of consuming seafood harvested from such areas. Previous research has already shown that barium accumulates in mammalian bone and in diatoms (B.D. Lucky, B. Verugopal, and D. Lucky, Heavy Metal Toxicity, Safety and Homology, George Thieme Publishers, 1975).

It has also been reported (Science, Vol. 193, No. 4247, p. 57) that, while barium occurs only in trace amounts in the marine environment, it is so persistent that it has recently been proposed as an indicator of previous offshore drilling sites. In addition, some estimates of discharges from oil drilling activities indicate that substantial amounts of barium could be transported great distances (Williams, S. and Jones, J., "Study of Distribution and Origin of Bottom Sediments in the Louisiana Oil Patch Adjacent to Timbalier Bay, Louisiana," sponsored by Gulf Universities Research Consortium in conjunction with the Offshore Ecology Investigation).

Oil Spill Response

The draft EIS presentation of oil spill response under the section entitled "Mitigating Measures" is limited. There is little discussion of shoreline protection, restoration, and wildlife management during a spill, nor expected recovery effectiveness. Statistical programs are available which are capable of predicting recovery effectiveness based on a variety of environmental conditions (Shell Oil has developed such a program). Information from this program should be included in the discussion on spill response and clean-up capabilities. Additionally, site accessibility should be discussed in detail, including time required to respond in given spill scenarios depending upon geographical location. An estimation of equipment availability should also be presented.

On-Shore Effects

On page 53, in the "Environmental Impact" section of the EIS, it is estimated that from zero to two terminal storage facilities may be constructed on shore as a result of proposed sales. We suggest that the Final EIS discuss more thoroughly these proposed actions, their environmental effects and measures which might serve to mitigate any predicted adverse effects.

The EIS very clearly states that there is currently an air pollution problem along the Texas coast. However, in the discussion of the potential impact of this proposed lease sale on the existing air quality, there is no mention of the contribution of fugitive air emissions, nor operational air emissions resulting from disposal of recovered gases. We assume that the present disposal practices for these gases, dilution or flaring, will contribute to the present air quality problems.

Spills

The discussion of mitigative measures reported that significant oil spills of more than 15 barrels had occurred while drilling rigs were taking on diesel fuel from a supply rig. The spills occurred when the fuel tank overflowed through a venting line because of the inattentiveness of control room operators. We suggest that preventive measures be taken so that similar spills do not occur. We recommend that such venting lines be drained to collecting basins or reservoirs to contain such overflows.

Produced Water - Area of Contamination

The presentation on the impact of disposal of produced water does not provide estimates of the pollution effects resulting from such disposal. In a recent report issued by the Department of the Environment, United Kingdom, 10 micrograms per liter of oil in water above the background level is selected as the "safe" level for oil components in sea water. Assuming an oil content of 25 milligrams per liter in the produced water, the United Kingdom report concludes that approximately 125 acres around each platform will be above the 10 micrograms per liter "safe" level. We suggest that BLM consider performing similar analyses to determine the area around each platform necessary for the dilution and dispersion of produced water. (A method for computing dilution is contained in "User's Guide and Documentation for Outfall Plume Model," by D. Baumgartner, P.L. Trent, K.V. Byram, Working Paper No. 30, EPA Pacific Northwest Water Laboratory, May 1971, NTIS PB 204-557).

Fisheries - High Risk Tracts

The EIS indicates (p. 40, "Environmental Impacts" section) that three tracts contain parts of offshore fishing banks. We endorse the proposal that "protective environmental stipulations" be included in the leases for these tracts. The EIS concludes, however, that the long-term, indirect impacts of drilling and production operation on reefs and banks cannot be predicted. For these reasons, EPA suggests that these tracts (and others identified in the Summary Risk Analysis section as environmental "high risk" tracts) be deleted from the sale.

These tracts could be offered for sale at a later date, if subsequent studies or experience leads to lower risk assessment for the tracts.

Manager, New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building, Suite 841
500 Camp Street
New Orleans, Louisiana 70130

JUL 2 1976

Dear Sir,

We appreciate the opportunity to comment on the Draft Environmental Impact Statement (DEIS) covering the proposed Gulf of Mexico Outer Continental Shelf (OCS) Oil and Gas Lease Sale No. 44. The DEIS was circulated to the public on June 2, 1976, and describes a total area of 255,163 acres in 61 different tracts. The estimated hydrocarbon reserves in the area consist of from 100 to 200 million barrels of oil and from 2 to 3 trillion cubic feet of natural gas.

The Federal Power Commission's Bureau of Natural Gas offers the following comments:

(1) Because the DEIS describes a hydrocarbon resource area of considerable significance to future domestic energy production, the staff recommends that further discussion be provided on the deteriorating national gas supply situation. As shown in the attached Federal Power Commission News Release No. 22438, the inability of currently available gas supplies to meet customer demands has forced interstate pipeline companies to project a net total gas curtailment of 3.6 trillion cubic feet for the year ending March 31, 1977. This level of curtailment would be about 25 percent of the total interstate firm natural gas requirements for the same interval. Because of this shortage in gas supply, there is an urgent need for the discovery and development of new gas reserves.

(2) It is not the responsibility of the Federal Power Commission to inventory coastal zone and OCS features, resources, and hazards. We, therefore, defer comment on the environmental impact of OCS leasing to other, more appropriate Federal, state, and local agencies. However, the Commission is responsible for the analysis of applications proposing the construction of specific natural gas pipelines and related facilities for use in interstate commerce. When new interstate facilities are proposed in an application, a detailed environmental evaluation is made in order to identify potential environmental impacts related to that particular project.

- 2 -

The Commission is actively directing its attention and efforts towards regulatory actions to improve the current imbalance between natural gas supply and demand. We recognize the importance of a responsible approach allowing the development of additional energy supplies while at the same time giving full consideration to environmental issues. Based upon a review of your DEIS, we believe that the proposed OCS oil and gas lease sale would be in the national interest.

S. William Yost, Chief
Bureau of Natural Gas

Attachment: FPC News Release No. 22438

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUN 15 1976

Bureau of Land Management
ATTN: Manager, New Orleans OCS Office
Hale Boggs Federal Building
Suite 841
500 Camp Street
New Orleans, Louisiana 70130

Dear Sirs:

This is in response to your letter of June 2, 1976, inviting our comments on the Draft Environmental Impact Statement for the proposed 1976 Outer Continental Shelf Oil and Gas Lease Sale, Gulf of Mexico.

We have reviewed the statement and determined that the proposed action, per se, has neither radiological health and safety impacts nor will it adversely affect any activities subject to regulation by the Nuclear Regulatory Commission. Accordingly, we have no comments to offer.

Thank you for providing us with the opportunity to review this draft environmental impact statement.

Sincerely,

Voss A. Moore, Assistant Director
for Environmental Projects
Division of Site Safety and
Environmental Analysis

cc: Director, Bureau of Land Management
Department of Interior

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UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
POST OFFICE BOX 1306
ALBUQUERQUE, NEW MEXICO 87103

IN REPLY REFER TO:
HP

RECEIVED
APR 30 7 20 AM '76
BUREAU OF LAND MGMT.
OUTER CONTINENTAL
SHELF OFFICE
NEW ORLEANS, LA.

April 26, 1976

Memorandum

To: Manager, New Orleans OCS Office, New Orleans, Louisiana

From: Assistant Regional Director, FWS, Albuquerque, New Mexico (ES)

Subject: Proposed Stipulations for OCS Lease Sale No. 44

This is in response to your April 6, 1976, request for comments on the above subject. We have reviewed the proposed stipulations and offer the following comments.

It is believed that the offshore Texas tracts involved in the subject lease sale do not contain fishing or hard bank biological communities. Nevertheless, we are concerned about the adequacy of Special Stipulation (b) which is supposed to protect such features. As written, the stipulation essentially requires the lessee to submit a bathymetric map and, if the lessee's exploration and/or development plan is approved, to provide a log that will identify materials introduced into the marine environment. This information would be helpful in assessing the impact of exploration and development activities, but would do nothing to protect fishing or hard bank communities from such activities. As a minimum, the stipulation should allow the use of such protective measures as prohibiting the siting of structures on the top and slopes of banks, shunting drill cuttings and muds to the bottom, transporting cuttings and muds to approved offshore or onshore locations, and prohibiting the bulk dumping of drilling muds in the vicinity of banks and reefs.

A potential problem also not addressed by the proposed stipulations is that of protecting unique biological features identified or more precisely located after a lease sale takes place. This potential problem may best be handled by requiring the submission of bathymetric or other data with the exploration and/or development plans of all lessees. Appropriate protective measures should then be undertaken in the vicinity of unique features located in this manner.

Another mechanism for protecting unique biological features, previously discussed in a memorandum from our Galveston Field Office dated

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

February 27, 1976, is that of utilizing existing regulations to identify and, where necessary, to protect unique biological features.

The regulation 30 CFR 250.34(a), item 4 could be used to attain such information as the bathymetry, bottom sediments, and organisms associated with a feature of concern. A corresponding regulation, 30 CFR 250.12, could then be used to require appropriate protective measures. It is suggested that the applicability of these and possibly other regulations be investigated prior to the final development of stipulations for the lease sale.

Thank you for the opportunity to review the proposed stipulations.

Jack P Woolstenhulme

cc:

Office of Biological Services, FWS, Albuquerque
Field Supervisor, ES, Galveston, Texas

---

United States Department of the Interior
FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

ADDRESS ONLY THE DIRECTOR, FISH AND WILDLIFE SERVICE

In Reply Refer To:
FWS/OBS

JUL 28 1976

Memorandum

To: Director, Bureau of Land Management

From: ACTING DEPUTY ASSOCIATE Director, Fish and Wildlife Service

Subject: Comments on Draft Environmental Statement Concerning a Proposed Oil and Gas Lease Sale Offshore Texas and Louisiana (OCS Sale No. 44)

The Fish and Wildlife Service has reviewed the subject statement and offers the following comments.

GENERAL COMMENTS

The draft environmental statement (DES) is generally adequate to assess most aspects of the proposed lease sale. Our primary concern involves those OCS exploration and development activities for which information is not available on which to base a reasonable prediction of impact. Specific impact categories which are discussed in more detail in the following paragraphs and appear to warrant further investigation are the effects of pipeline construction in marine and estuarine environments; the effects of drilling muds on marine life, particularly benthic and bottom feeding organisms; and the effects of pipelines on trawling gear.

An additional concern, also discussed in further detail below, is the need to formulate a means of dealing with adverse impacts which may not become known until after a lease sale takes place.

The comments which follow reference the specific sections of the DES to which they pertain.

RECEIVED
JUL 30 1976
DIVISION OF MINERALS
[illegible]

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SPECIFIC COMMENTS

Description of Proposal

It is stated on page 3 of this section that "...a reduction in the quantity of onshore facilities such as treatment plants, refineries, storage facilities, etc., is made possible by utilizing existing facilities..." If utilized to its maximum extent, this policy would stabilize rather than reduce the quantity of onshore facilities.

Description of the Environment

In the discussion of bottom currents on page 18, it may be advisable to point out that several recent monitoring efforts in the Gulf have shown no apparent relationship of bottom currents to surface currents. Therefore, readers should be cautioned not to make assumptions regarding bottom currents based on the surface current data given in the visual graphics.

The list of endangered species referred to on page 33 was revised in the September 26, 1975 issue of the Federal Register.

Also on page 33, in the section on "Marine Mammals, Birds, and Sea Turtles", a reference should be given for the statement, "The breeding ranges of the three species rare in the eastern Gulf, the Masked Booby Sula dactylatra, Red-footed Booby S. sula and Brown Booby S. leucagaste, though not well known, do not include the eastern Gulf of Mexico."

The reference to the 6 meter elevation line being roughly 48 meters inland (page 40) seems unrealistic. That elevation extends many miles inland in some areas of the Gulf Coast.

The reference to the Mississippi Delta as having the only freshwater marsh in the sale area (page 41) is erroneous. Coastal marshes commonly grade from saline to brackish to fresh. For example, an extensive freshwater marsh is found near the mouth of the Trinity River in Galveston Bay, Texas.

The discussion of various uses of water bodies on page 45 includes their filling for real estate development. Although a great deal of open water and marsh habitat has been lost to real estate development in the past, it should be pointed out that the value of these areas as nursery habitat for aquatic organisms and as a source of organic input into aquatic ecosystems is now well understood. This knowledge has resulted in the enactment of legislation designed to prevent the destruction of valuable wetland habitat unless it is in the overall public interest, has no feasible alternatives, and is conducted in the most environmentally acceptable manner possible.

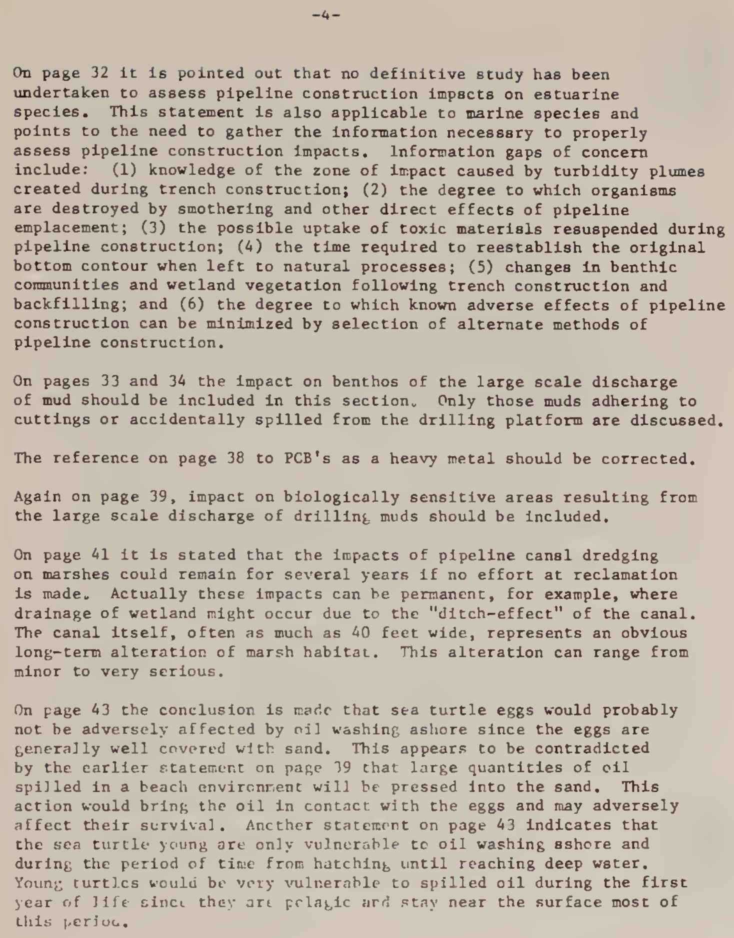
The red wolf should be added to the page 76 listing of endangered species which occur on Anahuac National Wildlife Refuge. Also on page 76, Delta-Breton National Wildlife Refuge is the new name for the former Gulf Islands Refuge, and the Sabine National Wildlife Refuge was established in 1937.

Environmental Impacts of the Proposed Action

The estimate is given on page 1 of this section that about 10 percent of the total volume of drilling mud used in the OCS area may be discharged into the ocean environment. This figure is apparently based on losses during normal drilling operations and does not take into account the possible bulk discharge of drilling muds during drilling and following the completion of a well. We have received indications from, among others, a representative of a company which supplies drilling muds that the bulk discharge of drilling muds is a common practice in the OCS area. This practice would greatly increase the amount of released muds on which the evaluation of drilling mud impact is based.

We, therefore, recommend that an analysis be made of the extent to which the discharge of drilling muds occurs in the OCS area. The results of this analysis should be included in the final environmental statement for this sale. It is also recommended that detailed studies be conducted to better define the impact of drilling muds. These studies should include analyses of the distribution and direct impacts of discharged drilling muds; toxic effects of muds, including the possible ingestion, accumulation, and magnification of drilling mud constituents in marine and estuarine life forms; and changes in population levels and components, especially in benthic communities, following various levels of discharge of drilling muds. Finally, some protection should be provided for the as yet unquantified effects of drilling muds by at least prohibiting the large-scale discharge of drilling muds in the vicinity of such unique and sensitive biotic features as fishing banks and coral reefs.

A better description of the large-scale discharge of muds should be included in this paragraph, along with the controls, records, etc., required by U.S. Geological Survey.



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On page 32 it is pointed out that no definitive study has been undertaken to assess pipeline construction impacts on estuarine species. This statement is also applicable to marine species and points to the need to gather the information necessary to properly assess pipeline construction impacts. Information gaps of concern include: (1) knowledge of the zone of impact caused by turbidity plumes created during trench construction; (2) the degree to which organisms are destroyed by smothering and other direct effects of pipeline emplacement; (3) the possible uptake of toxic materials resuspended during pipeline construction; (4) the time required to reestablish the original bottom contour when left to natural processes; (5) changes in benthic communities and wetland vegetation following trench construction and backfilling; and (6) the degree to which known adverse effects of pipeline construction can be minimized by selection of alternate methods of pipeline construction.

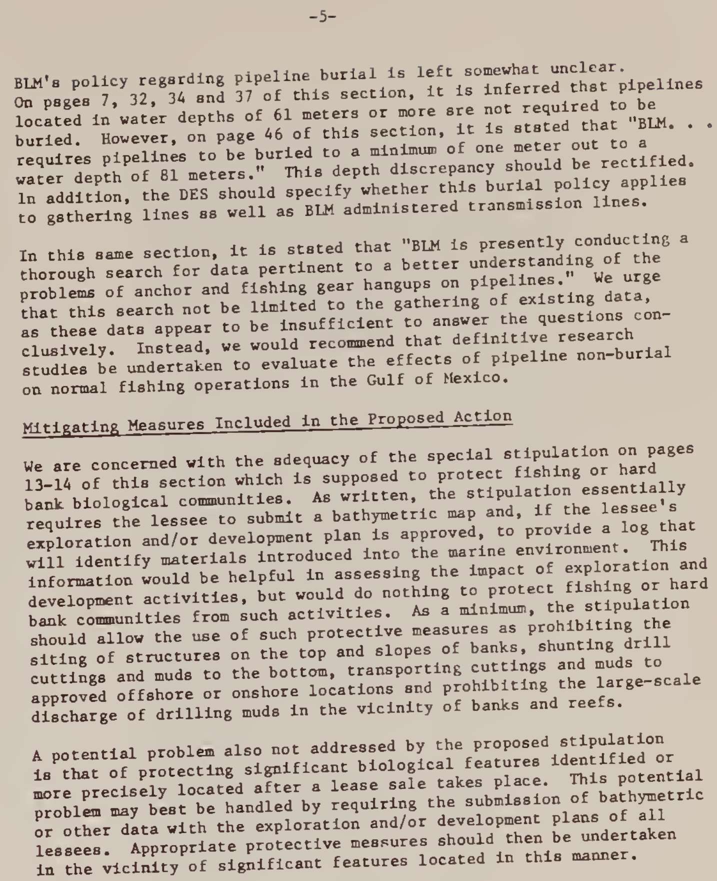
On pages 33 and 34 the impact on benthos of the large scale discharge of mud should be included in this section. Only those muds adhering to cuttings or accidentally spilled from the drilling platform are discussed.

The reference on page 38 to PCB's as a heavy metal should be corrected.

Again on page 39, impact on biologically sensitive areas resulting from the large scale discharge of drilling muds should be included.

On page 41 it is stated that the impacts of pipeline canal dredging on marshes could remain for several years if no effort at reclamation is made. Actually these impacts can be permanent, for example, where drainage of wetland might occur due to the "ditch-effect" of the canal. The canal itself, often as much as 40 feet wide, represents an obvious long-term alteration of marsh habitat. This alteration can range from minor to very serious.

On page 43 the conclusion is made that sea turtle eggs would probably not be adversely affected by oil washing ashore since the eggs are generally well covered with sand. This appears to be contradicted by the earlier statement on page 39 that large quantities of oil spilled in a beach environment will be pressed into the sand. This action would bring the oil in contact with the eggs and may adversely affect their survival. Another statement on page 43 indicates that the sea turtle young are only vulnerable to oil washing ashore and during the period of time from hatching until reaching deep water. Young turtles would be very vulnerable to spilled oil during the first year of life since they are pelagic and stay near the surface most of this period.



-5-

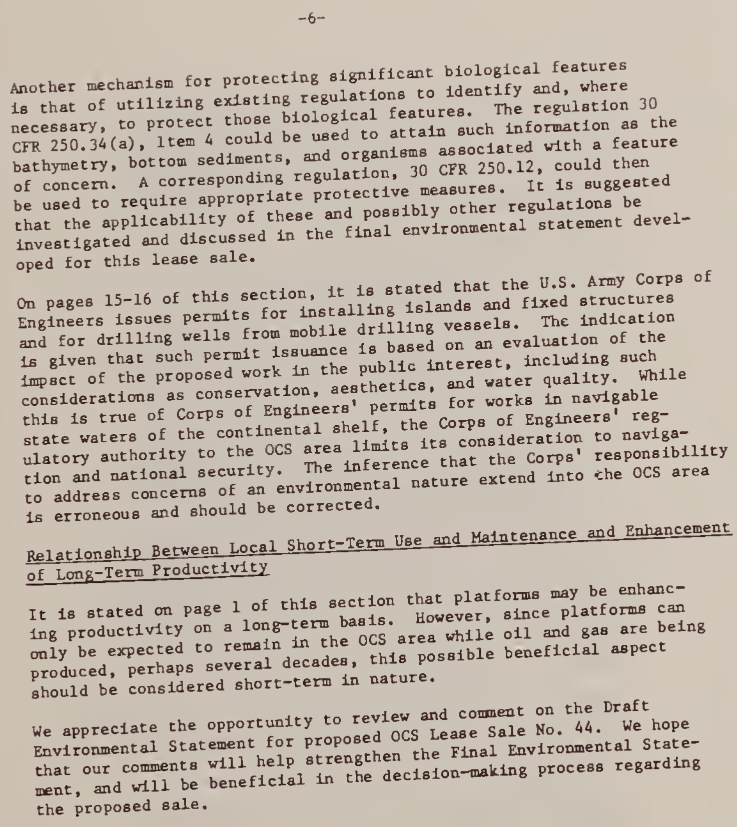
BLM's policy regarding pipeline burial is left somewhat unclear. On pages 7, 32, 34 and 37 of this section, it is inferred that pipelines located in water depths of 61 meters or more are not required to be buried. However, on page 46 of this section, it is stated that "BLM. . . requires pipelines to be buried to a minimum of one meter out to a water depth of 81 meters." This depth discrepancy should be rectified. In addition, the DES should specify whether this burial policy applies to gathering lines as well as BLM administered transmission lines.

In this same section, it is stated that "BLM is presently conducting a thorough search for data pertinent to a better understanding of the problems of anchor and fishing gear hangups on pipelines." We urge that this search not be limited to the gathering of existing data, as these data appear to be insufficient to answer the questions conclusively. Instead, we would recommend that definitive research studies be undertaken to evaluate the effects of pipeline non-burial on normal fishing operations in the Gulf of Mexico.

Mitigating Measures Included in the Proposed Action

We are concerned with the adequacy of the special stipulation on pages 13-14 of this section which is supposed to protect fishing or hard bank biological communities. As written, the stipulation essentially requires the lessee to submit a bathymetric map and, if the lessee's exploration and/or development plan is approved, to provide a log that will identify materials introduced into the marine environment. This information would be helpful in assessing the impact of exploration and development activities, but would do nothing to protect fishing or hard bank communities from such activities. As a minimum, the stipulation should allow the use of such protective measures as prohibiting the siting of structures on the top and slopes of banks, shunting drill cuttings and muds to the bottom, transporting cuttings and muds to approved offshore or onshore locations and prohibiting the large-scale discharge of drilling muds in the vicinity of banks and reefs.

A potential problem also not addressed by the proposed stipulation is that of protecting significant biological features identified or more precisely located after a lease sale takes place. This potential problem may best be handled by requiring the submission of bathymetric or other data with the exploration and/or development plans of all lessees. Appropriate protective measures should then be undertaken in the vicinity of significant features located in this manner.



-6-

Another mechanism for protecting significant biological features is that of utilizing existing regulations to identify and, where necessary, to protect those biological features. The regulation 30 CFR 250.34(a), Item 4 could be used to attain such information as the bathymetry, bottom sediments, and organisms associated with a feature of concern. A corresponding regulation, 30 CFR 250.12, could then be used to require appropriate protective measures. It is suggested that the applicability of these and possibly other regulations be investigated and discussed in the final environmental statement developed for this lease sale.

On pages 15-16 of this section, it is stated that the U.S. Army Corps of Engineers issues permits for installing islands and fixed structures and for drilling wells from mobile drilling vessels. The indication is given that such permit issuance is based on an evaluation of the impact of the proposed work in the public interest, including such considerations as conservation, aesthetics, and water quality. While this is true of Corps of Engineers' permits for works in navigable state waters of the continental shelf, the Corps of Engineers' regulatory authority to the OCS area limits its consideration to navigation and national security. The inference that the Corps' responsibility to address concerns of an environmental nature extend into the OCS area is erroneous and should be corrected.

Relationship Between Local Short-Term Use and Maintenance and Enhancement of Long-Term Productivity

It is stated on page 1 of this section that platforms may be enhancing productivity on a long-term basis. However, since platforms can only be expected to remain in the OCS area while oil and gas are being produced, perhaps several decades, this possible beneficial aspect should be considered short-term in nature.

We appreciate the opportunity to review and comment on the Draft Environmental Statement for proposed OCS Lease Sale No. 44. We hope that our comments will help strengthen the Final Environmental Statement, and will be beneficial in the decision-making process regarding the proposed sale.

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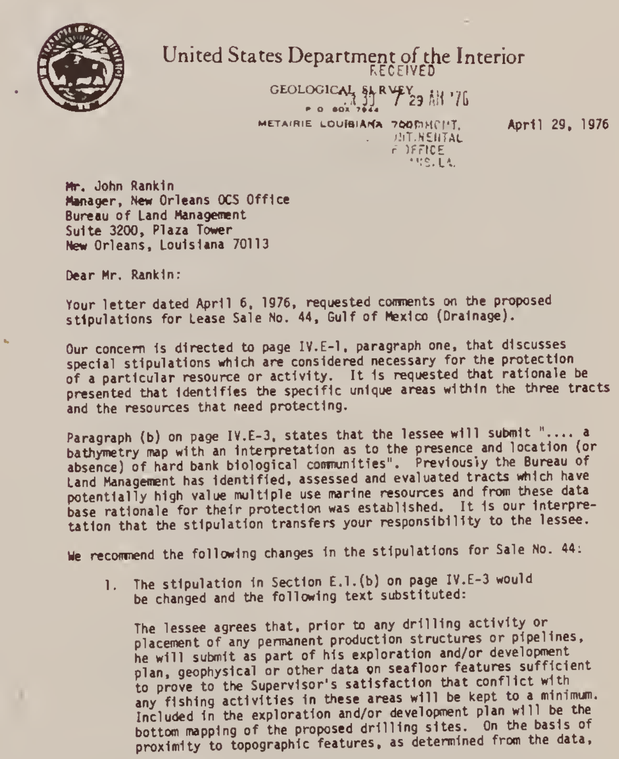

United States Department of the Interior
GEOLOGICAL SURVEY
P O BOX 7944
METAIRIE LOUISIANA 700

RECEIVED
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OFFICE
NS. LA.

April 29, 1976

Mr. John Rankin
Manager, New Orleans OCS Office
Bureau of Land Management
Suite 3200, Plaza Tower
New Orleans, Louisiana 70113

Dear Mr. Rankin:

Your letter dated April 6, 1976, requested comments on the proposed stipulations for Lease Sale No. 44, Gulf of Mexico (Drainage).

Our concern is directed to page IV.E-1, paragraph one, that discusses special stipulations which are considered necessary for the protection of a particular resource or activity. It is requested that rationale be presented that identifies the specific unique areas within the three tracts and the resources that need protecting.

Paragraph (b) on page IV.E-3, states that the lessee will submit ".... a bathymetry map with an interpretation as to the presence and location (or absence) of hard bank biological communities". Previously the Bureau of Land Management has identified, assessed and evaluated tracts which have potentially high value multiple use marine resources and from these data base rationale for their protection was established. It is our interpretation that the stipulation transfers your responsibility to the lessee.

We recommend the following changes in the stipulations for Sale No. 44:

1. The stipulation in Section E.1.(b) on page IV.E-3 would be changed and the following text substituted:

   The lessee agrees that, prior to any drilling activity or placement of any permanent production structures or pipelines, he will submit as part of his exploration and/or development plan, geophysical or other data on seafloor features sufficient to prove to the Supervisor's satisfaction that conflict with any fishing activities in these areas will be kept to a minimum. Included in the exploration and/or development plan will be the bottom mapping of the proposed drilling sites. On the basis of proximity to topographic features, as determined from the data, these sites shall be located as to cause minimal conflict with any fishing activities in these areas.

2. The stipulation in Section E.1.(c)(1), fourth line, would be changed from "not to interfere" to "to be compatible".

Sincerely,

Conservation Manager

---

United States Department of the Interior
GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

OFFICE OF THE DIRECTOR

AUG 2 1976
New Orleans La

JUL 27 1976

Memorandum

To: Manager, New Orleans OCS Office,
Bureau of Land Management, New Orleans, Louisiana

Through: Assistant Secretary--Energy and Minerals

From: Director, Geological Survey

Subject: Review of draft environmental statement for proposed oil and gas lease sale No. 44, Offshore Texas and Louisiana

We have reviewed the subject draft environmental statement as requested in a memorandum of June 2 from the Director, Bureau of Land Management.

Volume 1

Part I

Page 7, last par.--the proposed Seadock terminal will be in block 430, not 439.

Part II

Page 4, col. 2, par. 2--change "Acting faults" to "Active faults."

Page 7, Bottom Sediments--the second sentence should read "The overall pattern of deposition is one of regression interrupted by minor transgression."

Page 11, par. 5--the first sentence should read "a veneer of Miocene and Pliocene overlain by a thicker section of Pleistocene sediments."

Part III

Page 1, col. 2, par. 4--it is not true that sodium lignosulfonate has replaced ferrochrome lignosulfonate in a majority of Gulf offshore mud systems. Sodium lignosulfonates are used infrequently as emulsifiers and for treating special lime-caustic muds and do not replace ferrochrome or chromium lignosulfonates (CLS or FCLS), which are the most widely used and versatile thinning agents presently available. The caustic (NaOH) in commercial drilling muds combines with the CLS or FCLS to form a sodium salt or sodium chroma lignosulfonate. This may be the reason for the confusion between sodium lignosulfonates and CLS or FCLS. The contradiction between the second and third sentences in this paragraph should be resolved.

Page 5, col. 2, par. 5--the proposed EPA "best available technology" (BAT) regulations are not designed to achieve zero discharge but to achieve reasonable further progress toward the goal of eliminating the discharge of all pollutants. The proposed regulations require zero discharge of produced waters (reinjection) in State waters, and this requirement is being challenged in court. The no-charge discussion in this paragraph is, therefore, not relevant at this time.

Page 7--it is recommended that the following text be substituted for the two paragraphs titled "Oil and/or Gas Well Blowouts During Drilling."

> Imminent blowouts may be controlled by increasing mud weight and activating blowout preventers. If these control systems fail, the well being drilled may blow out of control. Quantities of drill mud, cuttings, sediment, and some oil and gas may be released to the marine environment. If a producing oil well blows out, large quantities of oil and gas may be released into the marine environment; and, if a producing gas well blows out, escaping gas either burns or disperses into the atmosphere.
>
> Outer continental shelf statistics indicate that one blowout occurs for every 2,860 wells drilled. An average of 2,100 barrels of oil is spilled for each blowout, but most blowouts causing spillage result from producing oil wells and not wells being drilled. Producing oil well blowouts are normally a result of equipment malfunctions, workover procedures, human errors, storms, and collisions with marine transportation.

Page 9, col. 2, par. 7 and table A-5--it is not correct to consider the hydrocarbons discharged with produced waters in concentrations of 50 ppm or less as "oil spillage" and to combine this discharge with estimates of spillage from other sources. The former are regular discharges permitted by both USGS and EPA. They contrast with spillage for which the operator is subject to punitive action when the discharges are intentional or when they are the result of violations of operating regulations. There is also no indication that hydrocarbon discharges on the order of 50 ppm have any detrimental impacts on marine ecosystems. Dispersal quickly reduces the hydrocarbon levels to the low parts per billion range, which may be beneficial to marine organisms.

Page 13, table A-4--this table is not correct and should be revised to conform with the enclosed table.

Page 15, col. 2, last par.--it should be noted that floating and/or underwater storage systems are highly unlikely as a result of this sale.

Page 25--we do not find any evidence of consideration of effects of oil spills and pipeline breaks on shallow unconfined coastal aquifers such as those found beneath the barrier islands, beaches and foredunes (Fisher, W. L., McGowen, J. H., Brown, L. F. Jr., and Grout, C. G., 1972, Environmental Geologic Atlas of the Texas Coastal Zone: Bureau of Economic Geology, Texas University, Austin, Texas, p. 61, vol. 1 of 2). The relatively rapid and deep migration of oil into coastal sediments is mentioned (p. 25), and biological and recreational impacts are considered (p. 39, 56-57). However, we find no mention of the underlying unconfined fresh water aquifers. The potential for impacts should be noted and mitigation evaluated.

Page 27, col. 1, par. 4--it should be noted that the 160,000-barrel pipeline spill occured prior to pressure-sensor and continuous-volume recording requirements, and the reoccurrence of such an incident is highly unlikely. Also, because of heavy sea conditions, there was never any indication of any pollution from this incident.

Page 32, col. 1, par. 2--the drilling times are reversed for the test well and the development well. Average drilling times for the average test well would be on the order of 45-80 days, while a development well would require approximately 30-60 days.

Page 49--a discussion of the merits of increased natural gas production for air quality should be included in this section. Natural gas is a complete burning fuel which creates no particulate matter, virtually no sulfur compounds, and far less nitric oxides than any other common fuel. Of the major fuels, natural gas can make the most significant contribution to alleviating air pollution.

Page 50, col. 1 par. 2--the residual chlorine in discharged waste waters is not a pollutant, but results from required treatment to counter potentially hazardous organisms.

Page 50, col. 1, par. 3—it should be pointed out that the BAT no-discharge requirements for produced waters apply only to State waters and that these requirements are being challenged in court.

Page 50, col. 1, last par.—EPA's BPCT and BAT regulations, which will be applicable to sewage discharges from OCS structures, require only a minimum of 1.0 ppm residual chlorine and do not specify maximum BOD and suspended solids levels.

Page 50, col. 2, last par.—It is incorrect to state that no detailed studies have been made on the impact of mud and cuttings discharges. A list of such studies can be provided.

Page 53, col. 2, par. 2—the EPA analyses detected measurable quantities of heavy metals in only isolated samples. Of EPA's 75 samples taken from 25 discharge points, only 6 had measurable concentrations of cadmium. No discharge had consistently measurable concentrations of cadmium in all 3 samples. None had detectable cyanide or mercury concentrations. While waste waters can contain toxic substances, the great majority do not. Also, there have been no indications of other than localized short-term impacts from these discharges, even in shallow bays.

Page 60, table L-1—there are several decimal point errors in the platform column of this table. In addition, the development scenario proposed is condensed into too short a time frame. If 40 platforms are to be installed and 300 development wells are to be drilled, installation of platforms and some development drilling would probably continue until at least 10 years after the sale. Similarly, the period for pipeline installation would also be extended. It is also recommended that table L-2 and table L-3, which show all investments within a five-year period after sale, be extended to cover a longer period.

Page 60, table L-2—the high estimate for platforms should be 80,000,000.

Part IV

Page 2, col. 1, last par.—inspections of drilling rigs and related equipment in the Gulf of Mexico are conducted at least once during the drilling of each exploratory well and during drilling of the first development well from a platform.

Page 13, col. 1 and 2—the stipulation on cultural resources should be changed to read as follows:

> If the Supervisor, having reason to believe that a site, structure, or object of historical or archeological significance, hereinafter referred to as "cultural resource," may

> exist in the lease area, gives the lessee written notice that the lessor is invoking the provisions of this stipulation, the lessee shall upon receipt of such notice comply with the following requirements:
>
> Prior to any drilling activity or the construction or placement of any structure for exploration or development on the lease, including but not limited to well drilling and pipeline and platform placement, hereinafter in this stipulation referred to as "operation," the lessee shall conduct geophysical surveys to determine the potential existence of any cultural resource that may be affected by such operations. All data produced by such geophysical surveys shall be examined by the Supervisor to determine if anomalies are present which suggest the existence of a cultural resource that may be adversely affected by any lease operation.
>
> If such anomalies exist the lessee shall: (1) locate the site of such operation so as not to adversely affect the anomaly identified; or (2) establish, to the satisfaction of the Supervisor, on the basis of further archeological investigation conducted by a qualified marine archeological surveyor using such survey equipment and techniques as deemed necessary by the Supervisor, either that such operation will not adversely affect the anomaly identified or that the potential cultural resource suggested by the occurrence of the anomaly does not exist. A report of this investigation prepared by the archeological surveyor shall be submitted to the Supervisor for review. Should the Supervisor determine that the existence of a cultural resource which may be adversely affected by such operation is sufficiently established to warrant protection, the lessee shall take no action that may result in an adverse effect on such cultural resource until the Supervisor has given directions as to its disposition.
>
> The lessee agrees that if any site, structure, or object of historical or archeological significance should be discovered during the conduct of any operations on the leased area, he shall report immediately such findings to the Supervisor, and make every reasonable effort to preserve and protect the cultural resource from damage until the Supervisor has given directions as to its disposition.

Page 13--the only apparent reason for stipulation 2 is that tracts 10, 11, and 61 are in the proximity of sport fishing areas. Because of the historical compatibility between OCS operations and sport fishing, the fact that many tracts have already been leased in similar areas, and the limited short-term impact of drilling activities on hard-bank communities, we consider this stipulation to be an unnecessary burden on the operators and recommend its deletion. It is also suggested that language which specifies the internal procedures which the Supervisor should follow in granting approvals not be included in lease stipulation.

Page 14, col. 1--the stipulation on structures for drilling or production, including pipelines should be changed to read as follows:

> Structures for drilling or production, including pipelines and subsea systems, shall be kept to the minimum necessary for proper exploration, development, and production and, to the greatest extent consistent therewith, shall be placed so as not to interfere unnecessarily with other significant uses of the Outer Continental Shelf, including commercial fishing.
>
> To this end, no structure for drilling or production, including pipelines and subsea systems, may be placed on the Outer Continental Shelf until the Supervisor has determined that the structure is necessary for the proper exploration, development, or production of the lease area and that no reasonable alternative placement would cause less interference with other significant uses of the Outer Continental Shelf, including commercial fishing.

Page 14, col. 1--the last stipulation is a superfluous reference to, and summary of, OCS Order No. 7. Because it adds nothing to the order's present requirements, this stipulation has been deleted from the Sale 40 Notice of Sale. We recommended that it also be deleted from the Sale 44 lease.

Acting Director

cc: Gen. Files AS-EM (2) Dir. Chron Director, PEP
BLM (advance) RU-760 BONHAM/ts/7-16-76/860-7556

MARINE MAMMAL COMMISSION
1625 EYE STREET, N. W.
WASHINGTON, DC 20006

3 August 1976

RECEIVED
AUG 6 1976
DIVIS[illegible]
ENVIRONM[illegible] [illegible]SSMENT

Manager
New Orleans Outer Continental Shelf Office
Bureau of Land Management
Hale Boggs Federal Building, Suite 841
500 Camp Street
New Orleans, LA 70130

Re: Comments on Draft Environmental Statement on Proposed OCS Sale No. 44

Dear Sir:

The Marine Mammal Commission in consultation with the Committee of Scientific Advisors on Marine Mammals has reviewed the draft environmental impact statement (DEIS) for proposed 1976 Outer Continental Shelf Oil and Gas Lease Sale, Gulf of Mexico, OCS Sale No. 44.

Pursuant to Section 202 of the Marine Mammal Protection Act of 1972 (P.L. 92-522) and in accordance with the published request of 2 June 1976 [Federal Register 41 (107):22289], the Marine Mammal Commission comments on the DEIS are hereby provided:

> Potential environmental impacts to marine mammals should be discussed in full in the EIS (Section IIIB7c and Section VIIC). The Commission finds the DEIS statements on potential impacts to marine mammals too cursory to facilitate sound decision making. Potential impacts, for example, due to oiling, noise, food resource depletion, physiological degradation and subsequent susceptibility to disease, behavioral and reproductive disruptions, and boat-animal collisions should be considered.
>
> While *Tursiops truncatus* and *Stenella plagiodon* are the most common small cetaceans (Section II, p. 38), *Physeter catodon* and *Globicephala macrorhyncha* may be relatively common larger cetaceans.

-2-

Because of the chronological overlap with offshore oil and gas development, the environmental statement should discuss the recent extinction of the Caribbean monk seal (*Monachus tropicalis*) and West Indian manatee (*Trichechus manatus*) from the region of the proposed sale [Section IIE4].

More than two dozen marine mammal species have been reported from the Gulf of Mexico. The relative abundance, seasonal distribution, and primary food resources of each species should be included in Table E-4 (Section II).

The marine mammal species listed in Table E-4 (Section II, p. 39) should include blue whale (*Balaenoptera musculus*), sei whale (*Balaenoptera borealis*), and pygmy killer whale (*Feresa attenuata*) according to the recent work of David J. Schmidly and Susan H. Shane [A Biological Assessment of the Cetacean Fauna of the Texas Coast. Texas A&M University Final Contract Report to the Marine Mammal Commission February 1976].

In Table E-4 (Section II, p. 39), the spelling should be corrected to read:

- Black Right Whale
- *Eubalena glacialis*
- *Megaptera novaeangliae*
- *Pseudorca crassidens*
- *Zalophus californianus*

Endangered marine mammals (*Trichechus manatus*, *Eubalena glacialis*, *Balaenoptera borealis*, *Balaenoptera musculus*, *Balaenoptera physalus*, *Megaptera novaeangliae*, and *Physeter catodon*) should be indicated in the environmental statement and potential impacts discussed [Sections IIE4 and IIIB8].

The potential impacts of warm water effluents (for example, produced formation water discharge) on biotic community composition, stability, and ecology should be fully discussed in the environmental statement [Sections IIIA2 and IIIB].

The conclusion on p. 42 Section III concerning impacts to marine mammals does not take into account depleted or otherwise threatened populations. For a depleted population, the percentage of the total population exposed to an accidental spill or other environmental threat may, in fact, be high.

-3-

We hope that the above comments will be helpful to you in the preparation of the final impact statement and in the subsequent consideration of the proposal.

Sincerely,

John R. Twiss, Jr.
Executive Director

cc: Mr. C. Berkland
Director, Bureau of Land Management

**Louisiana State Parks and Recreation Commission**
P.O. DRAWER 1111 BATON ROUGE, LOUISIANA 70821 TELEPHONE (504) 388-8761

GILBERT C. LAGASSE
DIRECTOR

July 1, 1976

Mr. John L. Rankin, Manager
New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
500 Camp Street, Suite 841
New Orleans, LA. 70130

Re: Proposed 1976 OCS Oil and Gas Sale No. 44, Gulf of Mexico

Dear Mr. Rankin:

We have received the subject dreft EIS and elthough we do not object to the proposed sale, we have the following comments:

1. There are three existing or proposed state park erees that could be impacted by development resulting from the sale. They ere: Grend Isle State Park, Cheniere Au Tigre, end Isles Denieres.
2. Should the sele result in development, we will review with cere eny pipeline (s) that transect the above erees. We anticipate coordinating efforts with the company constructing these pipelines much as we have done with previous contractors.
3. Continued visuel pollution resulting from additionel pletform construction as well as debris wash up on these beach areas resulting from construction efforts and well support activities continue to be a maintenance problem and are, therefore, of concern to us. Furthermore, the potential of an oil spill thet would damage these areas is always present. We urge that ell necessary precautions be teken in order to guard against this possibility.

We urge that these comments be taken in the constructive manner they ere made. Louisiana has extremely limited resources with respect to beech areas. We anticipate a continuation of the close coordination we have experienced in the past. Such an effort will allow the continued development of our offshore resources while retaining the integrity of our beach arees.

Sincerely,

Gilbert C. Lagasse
Gilbert C. Lagasse
Director

GCL/car

cc: IGR Commission
P.O. Box 44455
Baton Rouge, LA. 70804

---

STATE OF LOUISIANA
COMMISSION ON INTERGOVERNMENTAL RELATIONS

EDWIN EDWARDS
GOVERNOR
SENATOR MICHAEL H O'KEEFE
CHAIRMAN
LEON TARVER
EXECUTIVE DIRECTOR

P O BOX 44455
BATON ROUGE, LOUISIANA 70804
389 5664

June 15, 1976

1.2

Mr. John L. Rankin, Manager
New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
500 Camp Street
Suite 841
New Orleans, Louisiana 70130

SUBJECT: Proposed 1976 OCS Oil and Gas Lease Sale No. 44, Gulf of Mexico, Draft Environmental Impact Statement

Dear Mr. Rankin:

We have reviewed the subject environmental statement with respect to agency impact and responsibility.

A copy of the document has been forwarded for review and comment to the Louisiana state agencies listed on the attachment. Any comments forthcoming from these agencies will be forwarded to you by July 19, 1976.

A copy of the statement will be retained in our office and is available for public inspection, and a notice of availability will be published in our newsletter.

Sincerely,

D Braud
DeWitt H. Braud, Jr.
Environmental Coordinator

Enclosure

DHB:se

HOUSE COMMITTEE
J. RICHARD BREAUX
ROBERT FREEMAN
T W HUMPHRIES
ALPHONSE JACKSON JR
RICHARD THOMPSON

GOVERNOR'S COMMITTEE
KENNETH BOWEN
JOHN P COX
GORDON FLORY
[illegible] HAYNES
EDWARD STAGG

SENATE COMMITTEE
WILLIAM D BROWN
FREDERICK EAGAN
[illegible] D KIRKPATRICK
EDGAR G MOUTON
DONALD W WILLIAMSON

Wildlife and Fisheries Commission
Louisiana Geological Survey
Louisiana Coastal Commission
Department of Art, Historical, and Cultural Preservation
Parks and Recreation Commission
Department of Conservation, Division of Natural Resources and Energy
Office of State Planning

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State of Louisiana

STATE MINERAL BOARD
POST OFFICE DRAWER 2827
BATON ROUGE, LOUISIANA 70821

RECEIVED
MAR 15 8 26 AM '76

March 12, 1976

Mr. John L. Rankin, Manager
U. S. Department of the Interior
New Orleans Outer Continental Shelf Office
Suite 3200, The Plaza Tower
1001 Howard Avenue
New Orleans, Louisiana 70113

Dear Mr. Rankin:

We have reviewed the Preliminary Draft Environmental Impact Statement for the proposed offshore sale # 44 and have no adverse comments to offer.

Sincerely,

William E. Howe
William E. Howe, Civil Engineer

WEH:fhd
cc: Mr. Terry Reeves, Urban Planner
State of Louisiana
Commission on Intergovernmental Relations
P. O. Box 44455
Baton Rouge, Louisiana 70804

State of Louisiana
WILD LIFE AND FISHERIES COMMISSION
400 ROYAL STREET
NEW ORLEANS 70130

J. BURTON ANGELLE
DIRECTOR

EDWIN EDWARDS
GOVERNOR

June 18, 1976

Mr. John L. Rankin, Manager
New Orleans OCS Office
Bureau of Land Management
Hale Boggs Federal Building
500 Camp Street, Suite 841
New Orleans, Louisiana 70130

Re: Louisiana Wild Life and Fisheries Commission's Comments on Proposed 1976 OCS Oil and Gas Lease Sale No. 44, Gulf of Mexico, Draft Environmental Impact Statement

Dear Mr. Rankin:

We have reviewed the draft environmental statement for OCS Oil and Gas Lease Sale No. 44, Gulf of Mexico.

We find the impact statement adequate and containing all environmental data needed to make valid ecological judgements. In view of the past history of satisfactory environmental control associated with the Outer Continental Shelf development and production off Louisiana, we would not anticipate any problems with the exploration and development which might be associated with the proposed 1976 OCS Oil and Gas Lease Sale No. 44, Gulf of Mexico.

Sincerely yours,

Lyle S. St. Amant
Assistant Director

LSSt.A:ja

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OFFICE OF THE GOVERNOR

DOLPH BRISCOE
GOVERNOR

May 7, 1976

RECEIVED
MAY 13 6 56 AM '76
BUR OF LAND MGMT.
OUTER CONTINENTAL
SHELF OFFICE
NEW ORLEANS, LA

Mr. John L. Rankin
Bureau of Land Management
Gulf of Mexico Outer Continental
Shelf Office
Suite 200, The Plaza Tower
1001 Howard Avenue
New Orleans, Louisiana 70113

Dear Mr. Rankin:

As your office requested, the preliminary draft environmental impact statement for Offshore Sale No. 44 has been circulated to Texas State agencies for their informational input.

Enclosed are comments received from reviewing agencies. Direct followup contact between members of your staff, Budget and Planning Office staff, and the reviewing State agencies has already occurred, so your agency now should have the most up-to-date information available for inclusion in the draft environmental impact statement.

The opportunity to share Texas expertise with the Department of Interior, on the offshore production of oil and gas, is a positive step in the direction of better coordination and closer cooperation in developing our nation's energy resources.

This Office is prepared to coordinate the review of the draft environmental impact statement for Offshore Sale No. 44 when it is received. If we can be of further assistance, please contact us.

Sincerely,

Charles D. Travis, Director
Budget and Planning Office

Enclosures

---

OFFICE OF THE GOVERNOR

DOLPH BRISCOE
GOVERNOR

July 13, 1976

Mr. John L. Rankin
Gulf of Mexico OCS Office
Bureau of Land Management
The Plaza Tower, Suite 3200
1001 Howard Avenue
New Orleans, Louisiana 70113

Dear Mr. Rankin:

In accordance with the National Environmental Policy Act of 1969 and the Texas Policy for the Environment, the draft environmental impact statement for the Proposed Outer Continental Shelf, Oil and Gas Lease Sale, Gulf of Mexico, OCS Sale Number 44 has been reviewed by the Budget and Planning Office and by interested or affected State agencies .

The review participants agreed that the document generally conforms to requirements of the National Environmental Policy Act and submitted the following comments for your consideration:

1. The General Land Office expressed concern about the possibility of accidental oil spills and emphasized the need for intergovernmental liaison throughout the exploration and development phases to avoid pollution of the Texas coastline.

2. The Texas Water Rights Commission concurred in the overall evaluation about incremental and separable onshore effects being difficult to identify and quantify. The Commission suggested additional discussion be included relative to congressional deliberations on amendments to the Outer Continental Shelf Land Act of 1953 and the Coastal Zone Management Act of 1972.

3. The Bureau of Economic Geology offered no adverse comments on the report, but noted several technical errors which should be corrected in the final environmental impact statement.

The Texas Parks and Wildlife Department, the Texas Water Quality Board and the Texas Industrial Commission reviewed the draft environmental impact statement and concurred generally with its contents.

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The Budget and Planning Office noted a few minor errors which should be corrected in the final environmental impact statement. In Section D (page 25) silica is incorrectly listed as an essential nutrient. On page 77, the location of the Las Palomas Wildlife Management area should be more precisely described. Also, regarding the biological environment of the coastal zone, additional description of animal species should be included. The report of Fruh, Gordon, et al, "Preliminary Environmental Assessment of the Effects of Man's Activities on Coastal Environmental Units," 1972, and Gordon and Oppenheimer's "Texas Coastal Biotopes: An Ecography," 1972, are suggested as current references.

In general, it is believed that the environmental impacts of the proposed oil and gas sale have been adequately discussed and documented. It is recommended that the enclosed comments of the review participants be considered in their entirety in revising the draft environmental impact statement.

Sincerely,

Charles D. Travis, Director
Budget and Planning Office

Enclosures

PLANNING PROGRAM
1700 North Congress
Austin, Texas 78701
(475-6902)

DOLPH BRISCOE
GOVERNOR

OFFICE OF THE GOVERNOR
DIVISION OF PLANNING COORDINATION
STATE CLEARINGHOUSE
Ph. 512/475-6166

JAMES M. ROS
DIRECTOR

RECEIVED
MAR 10 A.M.
Div. of Plan. Coord.

## COMMENTS

March 17, 1976

Mr. Albert Schutz
Office of the Governor
Division of Planning Coordination
Austin, Texas 78701

RE: Review of the Outer Continental Shelf Lease Sale #44 Preliminary Statement.

Dear Mr. Schutz:

The preliminary draft Environmental Impact Statement for the proposed Increase in Oil and Gas Leasing on the Outer Continental Shelf, Number 44, has been reviewed by the General Land Office, and we concur with the draft EIS as presented.

However, a massive oil spill accident durino drilling or production or blowouts in a high pressure zone could result in servere and wide soread damaqe of major consequence. Therefore, a need for close work and cooperation of all interested agents throughout the exploration and development phases should be encouraged to avoid pollution of the coastline.

A. J. Bishop
Person Conducting Review (Signature) * A. J. Bishop, Coordinator
Agency General Land Office Date March 17, 1976

---

General Land Office
AUSTIN, TEXAS 78701
BOB ARMSTRONG, COMMISSIONER

PLANNING PROGRAM
1700 North Congress
Austin, Texas 78701
(512-475-6902)

RECEIVE
MAR 31
Budget/Planni

March 22, 1976

Mr. Albert Schutz
Office of the Governor
Division of Planning Coordination
Austin, Texas 78701

RE: Review of the Outer Continental Shelf Lease Sale #44 Preliminary Draft Environmental Statement.

The preliminary draft Environmental Impact Statement for the proposed Increase In Oil and Gas Leasing on the Outer Continental Shelf, Number #44, has been reviewed by the General Land Office.

Matters for consideration are massive oil spill accidents durino drilling or production and blowouts in high pressure zones that could result in severe and widespread damage of major consequence, especially a beach area. Therefore, a need for close work and cooperation of all interested agents throughout the exploration and development phases should be encouraged to avoid pollution of the coast line.

Sincerely

Bob Armstrong
Bob Armstrong
Commissioner

BA:AJB:mlq

---

General Land Office
AUSTIN, TEXAS 78701
BOB ARMSTRONG, COMMISSIONER

RECEIVED
MAY 13 8 37 AM '76
BUR OF LAND MGMT
OUTER CONTINENTAL
SHELF OFFICE
NEW ORLEANS, LA

RECEIVED
APR 28
Budget/Planning

April 23, 1976

Mr. Charles O. Travis, Director
Budget and Planning Office
Office of the Governor
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Attention Mr. Albert O. Schutz

RE: Second Half of the Preliminary Draft Environmental Impact Statement for the Outer Continental Shelf Lease Sale #44

Dear Mr. Travis:

We have reviewed the second half of the preliminary draft Environmental Impact Statement for the proposed increase in oil and gas leasing on the outer continental shelf, number 44. It is our opinion that a potential risk of pollution exists because of the possibility of oil spillage. However, we concur with the statement that adverse impacts caused by such spillage would be local to the drill site and would not be long lasting.

The major matter for consideration is the possibility of a massive accidental oil spill which could result in severe and widespread damage of major consequence. Therefore, we recommend that close cooperation between all interested agents throughout the exploration and development phases be encouraged to avoid pollution of the coast line. We do not recommend that the alternatives outlined in this proposed lease sale be substituted because the environmental impacts of these alternatives are difficult to assess.

Yours,

Bob Armstrong
Bob Armstrong
Commissioner

---

## AGENCY REVIEW TRANSMITTAL SHEET

TO: Charles O. Travis, Director
Budget and Planning Office
Office of the Governor
(Attention: State Clearinghouse)

Date: Sent: June 7, 1976
Date: Due : June 30, 1976
Refer: EIS :6-06-002

FROM: Honorable Bob Armstrong-General Land Office

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT-PROPOSED 1976 OUTER CONTINENTAL SHELF OIL AND GAS LEASE SALE-GULF OF MEXICO-OCS SALE NO 44

We have reviewed the cited document and our comments as to the adequacy of treatment of environmental affects of concern are shown below:

| | Check (X) for each item<br>None | Comment enclosed |
|---|---|---|
| 1. Additional specific effects which should be assessed: | ✓ | |
| 2. Additional alternatives which should be considered: | ✓ | |
| 3. Better or more appropriate measures and standards which should be used to evaluate environmental effects: | ✓ | |
| 4. Additional control measures which should be applied to reduce adverse environmental effects or to avoid or minimize the irreversible or irretrievable commitment of resources: | | See comment below.* |
| 5. Our assessment of how serious the environmental damage from this project might be, using the best alternative and control measures: | | See comment below.* |
| 6. We identify issues which require further discussion or resolution: | ✓ | |

☐ This agency concurs with the implementation of this project.

☐ This agency does not wish to comment on the subject document because:

* The major matter for consideration is the possibility of a massive accidental oil spill; therefore, we emphasize the need for intergovernmental liaison throughout the exploration and development phases to avoid pollution of the coastline.

mailed out 6/30/76

Transferring Mr. Bishop's signature from his original form per his permission via telephone 7/12/76

Enclosure (s) Laverne Crawford

A. J. Bishop
Name & title of reviewing official

TEXAS
PARKS AND WILDLIFE DEPARTMENT

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RECEIVED
MAR 17 A.M.
Coord.

March 16, 1976

Mr. Leon Willhite
Clearinghouse Coordinator
Governor's Budget and Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Dear Mr. Willhite:

Reference is made to the preliminary draft environmental impact statement being prepared by the Bureau of Land Management for Outer Continental Shelf Lease Sale #44. The draft was submitted for review and comment by this agency on March 5, 1976.

As indicated in the letter from Mr. John L. Rankin of the Bureau of Land Management to the Division of Planning Coordination, dated February 25, 1976, the review of the preliminary draft has been limited to the "technical adequacy of the resource descriptions" of the Texas sections.

Discussion of the environment of the Texas coast and the fish and wildlife resources of the state in the draft is considered generally adequate. There are several subjects discussed in the draft which should be expanded, however, and this agency would be pleased to provide data and advice to the Bureau of Land Management in this regard.

The last paragraph of Section F.6. (Biological Environment of the Coastal Zone: Seagrasses) of the draft statement indicates a lack of data on seagrass communities of the Texas coast. The Texas Parks and Wildlife Department and other state and federal agencies have a considerable amount of data on file regarding seagrasses. These data vary in specificity and detail with the collecting agency and the geographical areas of study, but they should be quite adequate for the purpose of the environmental impact statement. The principal sources of these data are this Department, the Bureau of Economic Geology (University of Texas), the General Land Office, Texas A&I University, and the Corpus Christi office of the U. S. Geological Survey.

Mr. Leon Willhite
March 16, 1976
Page 2

This agency is also able to provide more complete and current data on sport fishing harvest and catch rates in Texas bays than were available when the preliminary draft statement was prepared. As indicated in Section G.3.a. (Recreation: Sport Fishing) of the draft, the Texas Parks and Wildlife Department has completed marine creel studies on Galveston Bay, San Antonio Bay, Aransas-Copano bays, and the upper Laguna Madre. On completion of those studies, similar work was begun on the remaining Texas bays; the results of the first six months of sampling under the new studies will be available within the next four to six weeks.

The Texas Parks and Wildlife Department will make these data available to the Bureau of Land Management as desired. If additional data or coordination are desired, please let us know.

The opportunity to review and comment on the preliminary draft statement is appreciated.

Sincerely,

Clayton T. Garrison

CLAYTON T. GARRISON
Executive Director

CTG:BDK:pm

---

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RECEIVED
APR 27 1976
Budget/Planning

April 26, 1976

Mr. Leon Willhite, Coordinator
State Clearinghouse
Governor's Budget and Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Dear Mr. Willhite:

Reference is made to the second half of the preliminary draft environmental impact statement for the Outer Continental Shelf Lease Sale No. 44 which you forwarded to this agency on April 6, 1976 for review and comment.

Section II (Description of the Environment) of the draft has been reviewed by this agency and our comments were forwarded to your office on March 16, 1976. The following comments, therefore, pertain to Section I and to Sections III through IX of the draft.

The second paragraph of Section IIIA6 (page IIIA36) is correct in its discussion of the effects of habitat loss on wildlife species, but it should be expanded to state that, while some species could emigrate to other suitable areas, many species could not do so because of competition with resident species in adjacent areas. Many marsh areas are presently being utilized to their full capacity by resident wildlife.

The accuracy of information regarding brown pelican rookeries, discussed on page IIIA4 of the draft, cannot be verified since the visuals which will accompany the final statement were not appended to the draft.

In Section IIIA7 (pages IIIA42 and IIIA43), it is stated that acute discharges of oil would probably have no adverse impact upon alligator populations. This conclusion is not considered valid since the alligator depends upon well-established marsh habitat for its supply of food species and for successful nesting. If the marsh inhabited by alligators is devegetated by an acute oil spill, as described in Section IIIA5 of the draft, the alligator population would be adversely affected to a degree dependent upon the time required for reestablishment of marsh vegetation.

Mr. Leon Willhite, Coordinator
April 26, 1976
Page 2

References throughout the draft regarding drilling muds are too vague to permit an adequate assessment of their probable environmental effects. While the draft does include information on the physical and chemical characteristics of drilling muds, it does not provide sufficient information regarding the disposal of the muds. Additional information is needed regarding the periodicity of mud discharges from drilling rigs and on the quantities to be discharged at each drilling site.

The draft states, on page IIIC2, that "It is impossible to backfill canals or ditches in marsh areas because of the unconsolidated nature of the substrate ..." This statement is in error since it is common practice to backfill canals and ditches in many marsh areas. Although some marsh areas are of such nature as to preclude the practicality of backfilling, most Texas marshes may be backfilled with little difficulty.

The reference to the requirement for neutralization of drilling mud in Section IVA1e (page IVA2) is vague and somewhat confusing. Neutralization generally refers to an adjustment of the acidity or alkalinity of a fluid; however, in the context of the section, the reference is to the neutralization of "toxic substances." The discussion of this topic should be expanded in the final statement to identify the toxic substances to be neutralized and the techniques used to effect the neutralization.

The discussion of the effects on marine organisms of drilling mud and formation water discharges should be expanded in Section VA. The discharge of drilling mud may be expected to reduce photosynthesis, to clog the gills of marine species, and to cause mortality or long-term sublethal effects on the marine flora and fauna by the action of toxic chemicals. Formation water discharges may cause direct mortalities, prevent the exchange of atmospheric gases at the water surface, taint the flesh of edible marine organisms, or reduce or alter the reproductive process of marine organisms. All such possible effects should be discussed.

The opportunity to review and comment on the draft environmental impact statement is appreciated.

Sincerely,

CLAYTON T. GARRISON
Executive Director

CTG:BDK:pm

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RECEIVED
JUN 1976
Budget/Planning

June 21, 1976

Mr. H. Anthony Breard, Coordinator
Natural Resources Section
Governor's Budget and Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Dear Mr. Breard:

Reference is made to the Draft Environmental Impact Statement: Proposed 1976 Outer Continental Shelf Oil and Gas Lease Sale, Gulf of Mexico - OCS Sale No. 44, which you forwarded for review and comment by this agency on June 7, 1976.

The Texas Parks and Wildlife Department has reviewed the draft and concurs with its content.

The opportunity to participate in the review and assessment of this document is appreciated.

Sincerely,

CLAYTON T. GARRISON
Executive Director

CTG:BOK:pm

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MEMORANDUM

RECEIVED

TO: Mr. Albert O. Schutz

FROM: Phyllis Procter

SUBJECT: OCS Lease Sale Number 44 Preliminary DES

DATE: March 11, 1976

Our main concern in reviewing this DES is that more correct information on Texas port facilities and tonnage handled is available. Bob Richards, Texas Coastal and Marine Council, is preparing an almanac on Texas ports at the present time. Also, the Corps of Engineers' news release published at the Public Affairs Office, 110-A Essayons Building, 400 Barracuda Avenue, Galveston, Texas 77550, 713/763-1211, Extension 305, has current information that is readily available.

sm 4/4

RECEIVED
MAR 12
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COORDINATION

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TEXAS INDUSTRIAL COMMISSION

714 Sam Houston State Office Building 512-475-4331 Box 12728, Capitol Station, Austin, Texas 78711 Telex No. 776-488

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Abilene
Chester C. Wine
Laredo
Mario Yzaguirre
Brownsville
James H. Harwell
Executive Director

MEMORANDUM

TO: Leon Willhite

FROM: Phyllis Procter

SUBJECT: Second Half of the Preliminary Draft Environmental Impact Statement for the Outer-Continental Shelf Lease Sale #44

DATE: April 29, 1976

The Texas Industrial Commission concurs with the implementation of the project, but does not wish to infer that we agree with all data presented under "economic effects".

After consultation with statisticians in the Coastal Zone Management project area, we are not satisfied that data presented regarding onshore economic impact will necessarily be consistent with state figures to be reported after the third year of the Coastal Zone Management program.

njg4/3

---

Budget and Planning Office 411 W. 13th
Office of the Governor
(Attn. State Clearinghouse)

Date: June 7, 1976

Date: Due: June 30, 1976

FROM: James H. Harwell - T. I. C.

Refer: EIS-6-06-002

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT-PROPOSED 1976 OUTER CONTINENTAL SHELF OIL AND GAS LEASE SALE-GULF OF MEXICO -OCS SALE NO. 44

RECEIVED

We have reviewed the cited document and our comments as to the adequacy of treatment of environmental effects of concern are shown below: JUN 1976

Budget/Planning

| | Check (✓) for each item | |
|---|---|---|
| | None | Comment enclosed |
| 1. Additional specific effects which should be assessed: | | |
| 2. Additional alternatives which should be considered: | | |
| 3. Better or more appropriate measures and standards which should be used to evaluate environmental effects: | | |
| 4. Additional control measures which should be applied to reduce adverse environmental effects or to avoid or minimize the irreversible or irretrievable commitment of resources. | | |
| 5. Our assessment of how serious the environmental damage from this project might be, using the best alternative and control measures: | | |
| 6. We identify issues which require further discussion or resolution: | | |

☑ This agency concurs with the implementation of this project.

☐ This agency does not wish to comment on the subject document because:

Neva P. Fisher - Research
Name & title of Reviewing official

Enclosure(s)

TE AS WATER QUALITY  OARD

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AUSTIN TEXAS

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OFFICE
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MAR 31
Budget/Planning

March 30, 1976

RE: Preliminary DES, Outer Continental Shalf Lease Sale #44

Mr. Charles D. Travis, Director
Budget and Planning Office
Office of the Governor
411 West 13th Street
Austin, Texas 78701

Dear Mr. Travis:

The staff of the Texas Water Quality Board has reviewed the preliminary draft environmental impact statement concerning the Outer Continental Shelf Lease Sale No. 44 and find the proposed statemant to cover most of the important issues connected with oil and gas production. We have some concern that the report fails to maks use of the data now available on the quality of water in the coastal area of Texas. The recent stream monitoring data of the Texas Water Quality Board and the Texas Water Development Board would show the actual quality of coastal streams and estuaries, and this type data would indicate more accurately the true water quality conditions.

The groundwater offshore would not be adversely affected since it is not considered to be of usable quality, as we have previously stated for other lease sales. On shore facilities are of special concern to us since they will need to comply with permit regulations of the Texas Water Quality Board for both liquid and solid waste disposal. Also, in instances of any spillage of oil or hazardous substances in coastal waters, the State of Texas Oil and Hazardous Substances Pollution Contigency Plan of January, 1975 will become effective.

Mr. Charles D. Travis, Director
March 30, 1976
Page Two

We appraciate the opportunity to review this praliminary draft environmental impact statement. If we can be of furthar assistanca, plsase lat me know.

Sincerely,

Emory G. Long, Director
Administrative Operations Division

ccs: TWQB Districts 6, 7, 11, 12

---

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AUSTIN TEXAS

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APR 27 1976
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13 8 37 AM '76
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CONTINENTAL
OFFICE
LA

April 26, 1976

Re: Second Half of Praliminary Draft Environmental Impact Statement for Outar Continental Shslf Leasa Sale #44

Mr. Charles D. Travis, Director
Budget and Planning Office
Office of the Governor
411 West 13th Street
Austin, Texaa 78701

Dear Mr. Travis:

The staff of the Texas Water Quality Board has reviewed the second half of the preliminary draft environmental impact statement concerning the Outer Continental Shelf Lease Sale No. 44 and find the proposed statement to cover most of the important issues connected with oil and gas production. We have no additional comments beyond our comments of March 29, 1976 except that we have noted that the potential impacts on water quality of the proposed lease sale may be found to be insignificant or significantly adverse, and the magnitude of these potential hazards should be answered by future research studies.

We appreciate the opportunity to furnish comments on this activity. If we can be of further assistance, please let us know.

Very truly yours,

Emory G. Long
Emory G. Long, Director
Administrative Operations

cc: TWQB Districts 6, 7, 11, 12

---

TEXAS WATER QUALITY BOARD

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1700 NORTH CONGRESS AVE
P O BOX 13246 CAPITOL STATION 78711
AUSTIN, TEXAS

June 30, 1976

Re: Draft Environmental Impact Statement - Proposed 1976 OCS Oil & Gas Leass Sala #44

Mr. Charles D. Travis, Director
Governor's Budget and Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

RECEIVED
1976

Dear Mr. Travis:

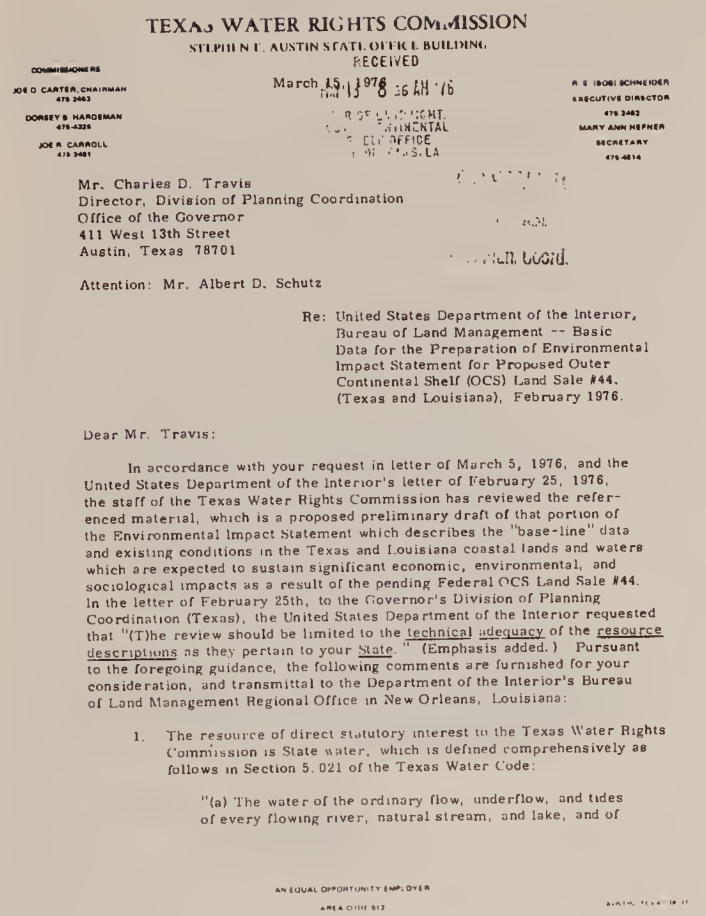
The staff of the Texaa Water Quality Board has reviewed the draft environmental impact statement for the proposed 1976 outer continental shelf oil and gas lease sale number 44 and find that the proposed statement covers most of the important issues connected with offshore oil and gas production. We have no additional comments beyond our comments submitted on April 26, 1976.

We appreciate tha opportunity to furnish commenta on this activity. If wa can ba of further aasiatance, please let us know.

Very truly yours,

Emory G. Long
Emory G. Long, Director
Administrative Operationa

cc: TWQB Districts 6, 7, 11, 12



TEXAS WATER RIGHTS COMMISSION
STEPHEN F. AUSTIN STATE OFFICE BUILDING

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NEW ORLEANS, LA

March 15, 1976

Coord.

Mr. Charles D. Travis
Director, Division of Planning Coordination
Office of the Governor
411 West 13th Street
Austin, Texas 78701

Attention: Mr. Albert D. Schutz

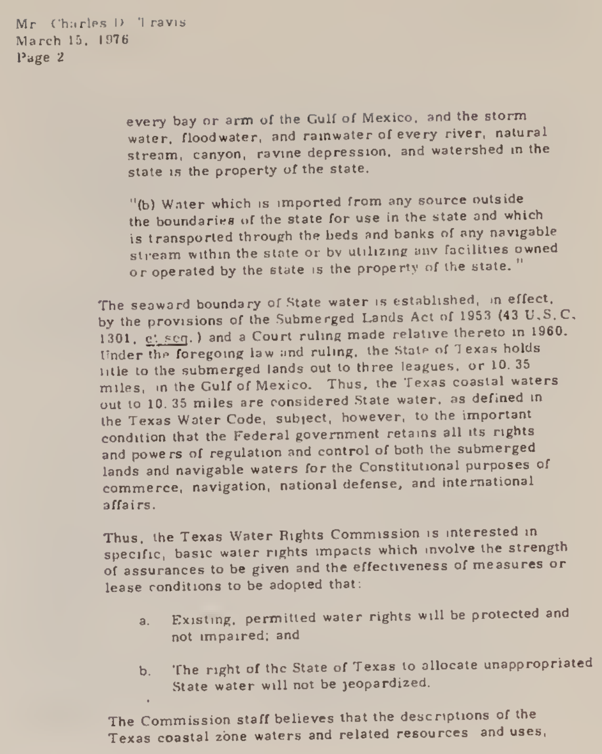
Re: United States Department of the Interior, Bureau of Land Management -- Basic Data for the Preparation of Environmental Impact Statement for Proposed Outer Continental Shelf (OCS) Land Sale #44, (Texas and Louisiana), February 1976.

Dear Mr. Travis:

In accordance with your request in letter of March 5, 1976, and the United States Department of the Interior's letter of February 25, 1976, the staff of the Texas Water Rights Commission has reviewed the referenced material, which is a proposed preliminary draft of that portion of the Environmental Impact Statement which describes the "base-line" data and existing conditions in the Texas and Louisiana coastal lands and waters which are expected to sustain significant economic, environmental, and sociological impacts as a result of the pending Federal OCS Land Sale #44. In the letter of February 25th, to the Governor's Division of Planning Coordination (Texas), the United States Department of the Interior requested that "(T)he review should be limited to the technical adequacy of the resource descriptions as they pertain to your State." (Emphasis added.) Pursuant to the foregoing guidance, the following comments are furnished for your consideration, and transmittal to the Department of the Interior's Bureau of Land Management Regional Office in New Orleans, Louisiana:

1. The resource of direct statutory interest to the Texas Water Rights Commission is State water, which is defined comprehensively as follows in Section 5.021 of the Texas Water Code:

   "(a) The water of the ordinary flow, underflow, and tides of every flowing river, natural stream, and lake, and of



Mr. Charles D. Travis
March 15, 1976
Page 2

every bay or arm of the Gulf of Mexico, and the storm water, floodwater, and rainwater of every river, natural stream, canyon, ravine depression, and watershed in the state is the property of the state.

"(b) Water which is imported from any source outside the boundaries of the state for use in the state and which is transported through the beds and banks of any navigable stream within the state or by utilizing any facilities owned or operated by the state is the property of the state."

The seaward boundary of State water is established, in effect, by the provisions of the Submerged Lands Act of 1953 (43 U.S.C. 1301, et seq.) and a Court ruling made relative thereto in 1960. Under the foregoing law and ruling, the State of Texas holds title to the submerged lands out to three leagues, or 10.35 miles, in the Gulf of Mexico. Thus, the Texas coastal waters out to 10.35 miles are considered State water, as defined in the Texas Water Code, subject, however, to the important condition that the Federal government retains all its rights and powers of regulation and control of both the submerged lands and navigable waters for the Constitutional purposes of commerce, navigation, national defense, and international affairs.

Thus, the Texas Water Rights Commission is interested in specific, basic water rights impacts which involve the strength of assurances to be given and the effectiveness of measures or lease conditions to be adopted that:

a. Existing, permitted water rights will be protected and not impaired; and

b. The right of the State of Texas to allocate unappropriated State water will not be jeopardized.

The Commission staff believes that the descriptions of the Texas coastal zone waters and related resources and uses,

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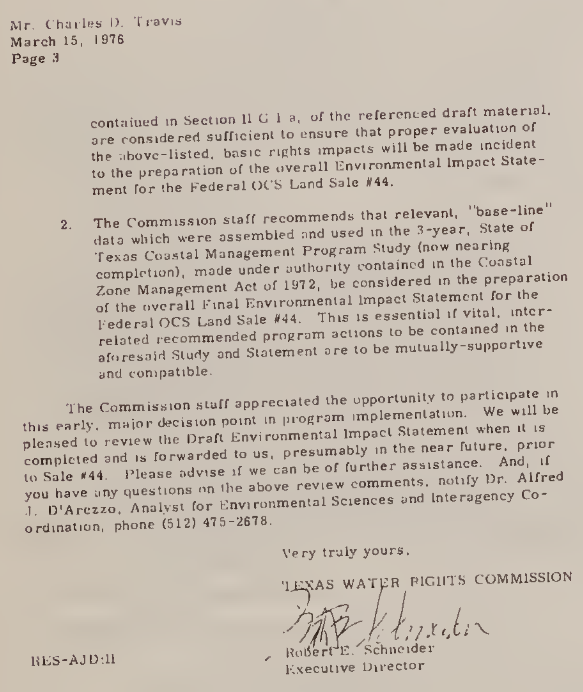

Mr. Charles D. Travis
March 15, 1976
Page 3

contained in Section II C 1 a, of the referenced draft material, are considered sufficient to ensure that proper evaluation of the above-listed, basic rights impacts will be made incident to the preparation of the overall Environmental Impact Statement for the Federal OCS Land Sale #44.

2. The Commission staff recommends that relevant, "base-line" data which were assembled and used in the 3-year, State of Texas Coastal Management Program Study (now nearing completion), made under authority contained in the Coastal Zone Management Act of 1972, be considered in the preparation of the overall Final Environmental Impact Statement for the Federal OCS Land Sale #44. This is essential if vital, inter-related recommended program actions to be contained in the aforesaid Study and Statement are to be mutually-supportive and compatible.

The Commission staff appreciated the opportunity to participate in this early, major decision point in program implementation. We will be pleased to review the Draft Environmental Impact Statement when it is completed and is forwarded to us, presumably in the near future, prior to Sale #44. Please advise if we can be of further assistance. And, if you have any questions on the above review comments, notify Dr. Alfred J. D'Arezzo, Analyst for Environmental Sciences and Interagency Co-ordination, phone (512) 475-2678.

Very truly yours,

TEXAS WATER RIGHTS COMMISSION

Robert E. Schneider
Executive Director

RES-AJD:ll

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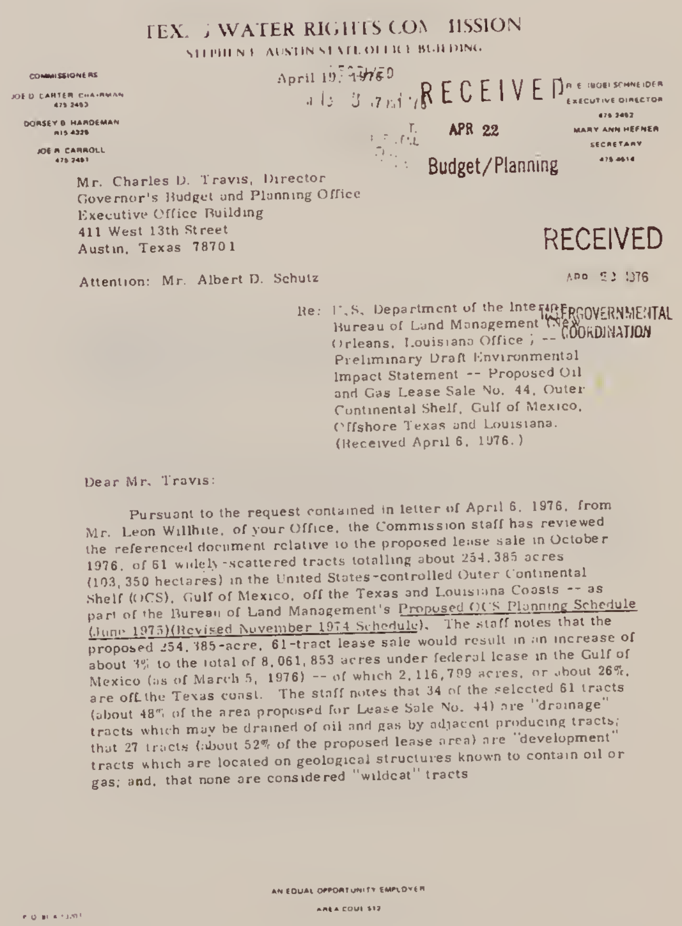

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April 19, 1976

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Mr. Charles D. Travis, Director
Governor's Budget and Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

RECEIVED
APR 23 1976
INTERGOVERNMENTAL
COORDINATION

Attention: Mr. Albert D. Schutz

Re: U.S. Department of the Interior, Bureau of Land Management (New Orleans, Louisiana Office) -- Preliminary Draft Environmental Impact Statement -- Proposed Oil and Gas Lease Sale No. 44, Outer Continental Shelf, Gulf of Mexico, Offshore Texas and Louisiana. (Received April 6, 1976.)

Dear Mr. Travis:

Pursuant to the request contained in letter of April 6, 1976, from Mr. Leon Willhite, of your Office, the Commission staff has reviewed the referenced document relative to the proposed lease sale in October 1976, of 61 widely-scattered tracts totalling about 254,385 acres (103,350 hectares) in the United States-controlled Outer Continental Shelf (OCS), Gulf of Mexico, off the Texas and Louisiana Coasts -- as part of the Bureau of Land Management's Proposed OCS Planning Schedule (June 1975)(Revised November 1974 Schedule). The staff notes that the proposed 254,385-acre, 61-tract lease sale would result in an increase of about 3% to the total of 8,061,853 acres under federal lease in the Gulf of Mexico (as of March 5, 1976) -- of which 2,116,799 acres, or about 26%, are off the Texas coast. The staff notes that 34 of the selected 61 tracts (about 48% of the area proposed for Lease Sale No. 44) are "drainage" tracts which may be drained of oil and gas by adjacent producing tracts; that 27 tracts (about 52% of the proposed lease area) are "development" tracts which are located on geological structures known to contain oil or gas; and, that none are considered "wildcat" tracts

Mr. Charles D. Travis
April 19, 1976
Page 2

The Commission staff has reviewed the referenced, site-specific Draft Environmental Impact Statement, on the planned Lease Sale No. 44, in conjunction with the encompassing final programmatic environmental impact statement for the overall Outer Continental Shelf Leasing Program, which was published and circulated by the U.S. Department of the Interior in July 1975. In addition, a cursory review has been made of the contract study entitled "Energy Alternatives: A Comparative Analysis by the Science and Public Policy Program of the University of Oklahoma," -- which was specially referred to on page VIII-B-1 of the referenced document. (i.e., "This study should be considered as an integral part of the alternatives portion of this EIS.")

The scope of review by the Commission staff was governed primarily by a consideration of State water rights impacts, and generally, by the criteria and guidelines contained in U.S. Office of Management and Budget Circular No. A-95. Within these constraints, the Commission staff recommends that the State Clearinghouse concur in the referenced document because:

1. The document appears to conform satisfactorily to the administrative, analytical, and coordinative guidelines of the National Environmental Policy Act of 1969, indicating that the Bureau of Land Management has developed and used a systematic, interdisciplinary process for formulating the OCS Lease Sale Program and its various elements.

2. The document indicates that detailed, continuing consideration has been given to post-leasing operations which could have substantial potential State water rights impacts. The specific post-leasing operations having such potential impacts are those operations involving the construction and operation of facilities which traverse State-controlled coastal waters, or are located onshore, in the coastal zone. Sufficient implied assurances are included in the referenced document, and in the programmatic environmental impact statement for the overall OCS Lease Sale Program that the protection of existing State water rights permits in the coastal zone will not be severely impaired, and that the Commission will not be impeded in its mission of allocating presently-unappropriated State waters for beneficial uses to authorized applicants for water use permits, consistent with State policies regarding the protection of bays and estuaries.

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Mr. Charles D. Travis
April 19, 1976
Page 3

3. Adequate assurances are given that the salient findings of continuing studies, such as the "MAFLA Environmental Baseline Study," the "MAFLA Monitoring Study," and the "South Texas Baseline Study," are promptly made known to the State, and are applied to advantage. The following statement on page VIII-C-6 of the referenced document typifies these assurances:

> "The information obtained from the completion of these studies has provided a greater degree of confidence than previously existed concerning the leasing of any given OCS area and the siting of offshore facilities, including pipelines, in relation to geologic, oceanographic, and biotic parameters. The distribution, numbers, and seasonal variations of species is useful information not only in the siting of offshore facilities but in determining pipeline routes and burial requirements, and in tract-by-tract evaluations concerning potential environmental impacts from offshore operations. Further information from these studies could prompt deletion of a tract or tracts prior to holding the sale based on unacceptable potential environmental risk. Information obtained thus far from the environmental studies program has provided information for the formulation of special stipulations and for the additional protection of environmental values within the proposed sale area." (Underlining added for emphasis.)

We appreciated the opportunity to review the referenced document, and we commend the planners concerned for their obviously high technical competence and thoroughness, which is reflected in the referenced document, and in the related documents mentioned herein. Please let us know if we can be of further assistance. If you have any questions on the foregoing, numbered comments, notify Dr. Alfred J. D'Arezzo, Analyst for Environment and Interagency Coordination, Phone: (512) 475-2678.

Very truly yours,

TEXAS WATER RIGHTS COMMISSION

Robert E. Schneider
Executive Director

RES-AJD:ll

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TEXAS WATER RIGHTS COMMISSION
STEPHEN F. AUSTIN STATE OFFICE BUILDING

COMMISSIONERS
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475 2453
DORSEY B HARDEMAN
475 4325
JOE R CARROLL
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R E (BOB) SCHNEIDER
EXECUTIVE DIRECTOR
475 2452
MARY ANN HEFNER
SECRETARY
475-4814

June 30, 1976

RECEIVED
JUL 1 1976
Budget/Planning

Mr. Charles D. Travis, Director
Governor's Budget and Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Attention: Mr. H. Anthony Breard

Re: United States Department of the Interior, Bureau of Land Management -- Draft Environmental Statement on Proposed 1976 Outer Continental Shelf Oil and Gas Lease Sale, Gulf of Mexico, OCS Sale No. 44 (Received June 8, 1976).

Dear Mr. Travis:

In reply to the request in Memorandum of June 7, 1976, from Mr. H. Anthony Breard of your Office, the staff of the Texas Water Rights Commission has reviewed the referenced Draft Environmental Statement (DES) on the proposed Bureau of Land Management Outer Continental Shelf Sale No. 44, Western (Texas) and Central (Louisiana), Gulf of Mexico.

The following comments and recommendations are furnished:

1. The referenced document appears to fulfill adequately the analytical, coordinative, and administrative requirements of the National Environmental Policy Act of 1969.

2. The referenced document has considered adequately the Commission staff's review comments contained in letter of March 15, 1976, to your Office (Re: United States Department of the Interior, Bureau of Land Management -- Basic Data for the Preparation of Environmental Impact Statement for Proposed Outer Continental Shelf (OCS) Land Sale #44. (Texas and Louisiana), February 1976.)

AN EQUAL OPPORTUNITY EMPLOYER
AREA CODE 512
AUSTIN TEXAS 78711

---

Mr. Charles D. Travis
June 30, 1976
Page 2

3. Analysis indicates that the overall impacts of the proposed Lease Sale No. 44 are not substantial insofar as the Texas Coast is concerned because only 7 of the 61 tracts are located offshore of the Texas Coast. Even so, the entire acreage to be listed in Sale No. 44 represents an increase of only 3% of the current total acreage under Federal lease in the Gulf of Mexico.

4. While the staff concurs in the overall evaluation that "... the incremental and separable onshore effects attributable to this Sale are difficult to identify and quantify...," (Section III, page 59, DES), and believes that an outstanding effort has been made to determine practical mitigating measures (Section IV, DES), the Commission staff suggests that some mention be made in Section IV, DES, of current congressional discussions concerning the amendment of the Outer Continental Shelf Land Act of 1953, and the Coastal Zone Management Act of 1972 regarding grants or loans to coastal states impacted by Outer Continental Shelf activities (e.g., see Congressional Record, June 14, 1976, page E 3303 and June 23, 1976, page H 6565).

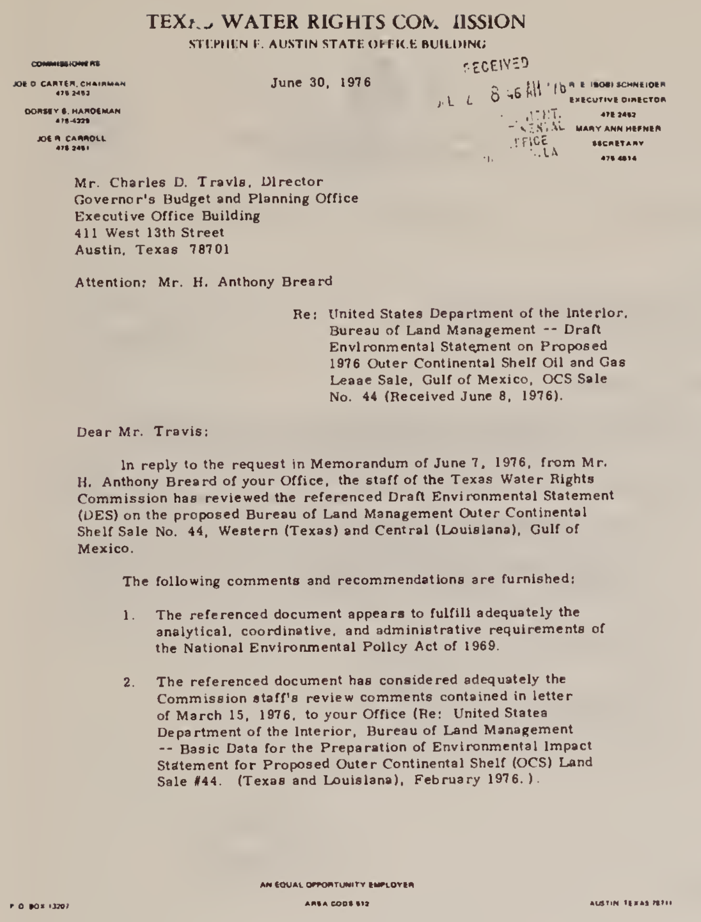
The Commission staff appreciated the opportunity to review the referenced document, and takes this opportunity to commend the authors and planners concerned in the preparation of the comprehensive, technical document. Please advise us if we can be of further assistance. And, if you have any questions on the above review comments, notify Dr. Alfred J. D'Arezzo, Analyst for Environmental Sciences and Interagency Coordination (Phone: (512)475-2678).

Very truly yours,

TEXAS WATER RIGHTS COMMISSION

Robert E. Schneider
Executive Director

RES-AJD:ll



TEXAS WATER RIGHTS COMMISSION
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COMMISSIONERS
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475 2453
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MARY ANN HEFNER
SECRETARY
475 4814

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June 30, 1976

Mr. Charles D. Travis, Director
Governor's Budget and Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Attention: Mr. H. Anthony Breard

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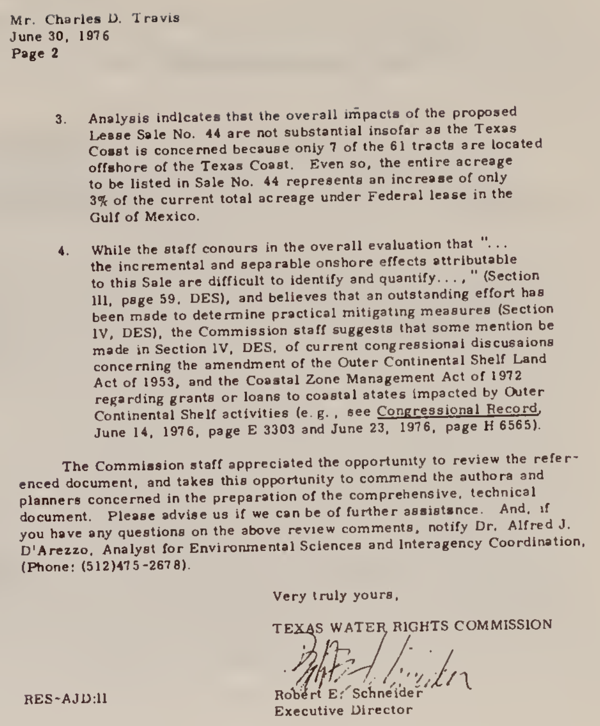
AN EQUAL OPPORTUNITY EMPLOYER
P. O. BOX 13207 AREA CODE 512 AUSTIN, TEXAS 78711



Mr. Charles D. Travis
June 30, 1976
Page 2

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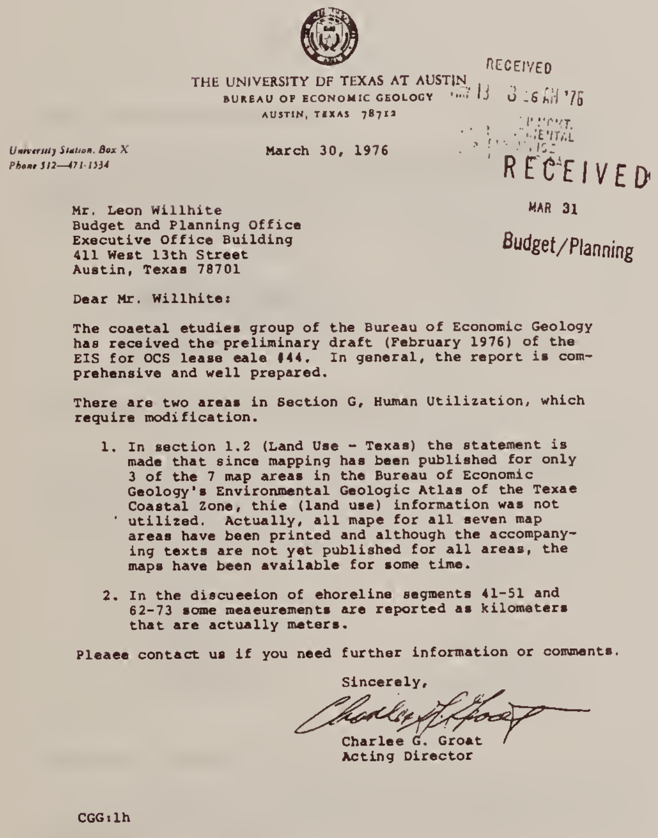
Very truly yours,

TEXAS WATER RIGHTS COMMISSION

Robert E. Schneider
Executive Director

RES-AJD:ll



THE UNIVERSITY OF TEXAS AT AUSTIN
BUREAU OF ECONOMIC GEOLOGY
AUSTIN, TEXAS 78712

University Station, Box X
Phone 512—471-1534

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MAR 31
Budget/Planning

March 30, 1976

Mr. Leon Willhite
Budget and Planning Office
Executive Office Building
411 West 13th Street
Austin, Texas 78701

Dear Mr. Willhite:

The coastal studies group of the Bureau of Economic Geology has received the preliminary draft (February 1976) of the EIS for OCS lease sale #44. In general, the report is comprehensive and well prepared.

There are two areas in Section G, Human Utilization, which require modification.

1. In section 1.2 (Land Use - Texas) the statement is made that since mapping has been published for only 3 of the 7 map areas in the Bureau of Economic Geology's Environmental Geologic Atlas of the Texas Coastal Zone, this (land use) information was not utilized. Actually, all maps for all seven map areas have been printed and although the accompanying texts are not yet published for all areas, the maps have been available for some time.

2. In the discussion of shoreline segments 41-51 and 62-73 some measurements are reported as kilometers that are actually meters.

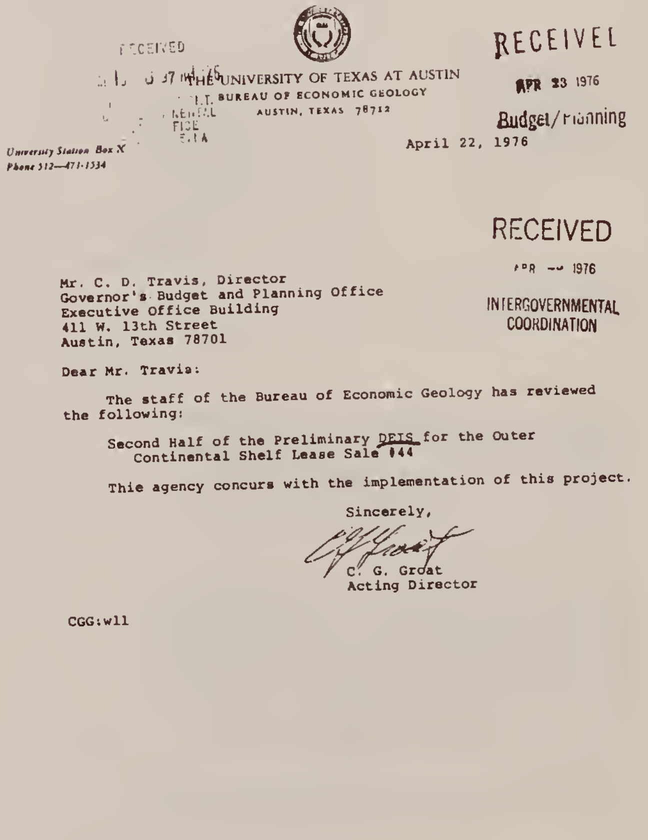
Please contact us if you need further information or comments.

Sincerely,

Charles G. Groat

Charles G. Groat
Acting Director

CGG:lh



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BUREAU OF ECONOMIC GEOLOGY
AUSTIN, TEXAS 78712

University Station Box X
Phone 512—471-1534

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APR 23 1976
Budget/Planning

April 22, 1976

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APR 1976
INTERGOVERNMENTAL COORDINATION

Mr. C. D. Travis, Director
Governor's Budget and Planning Office
Executive Office Building
411 W. 13th Street
Austin, Texas 78701

Dear Mr. Travis:

The staff of the Bureau of Economic Geology has reviewed the following:

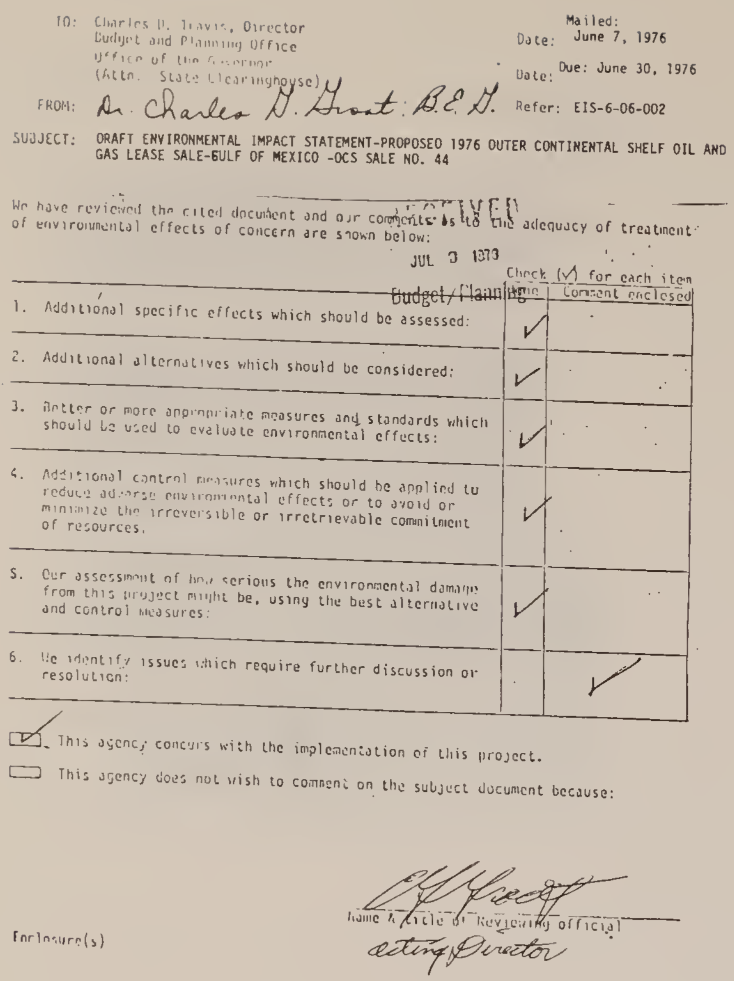
Second Half of the Preliminary DEIS for the Outer Continental Shelf Lease Sale #44

This agency concurs with the implementation of this project.

Sincerely,

C. G. Groat
Acting Director

CGG:wll



TO: Charles D. Travis, Director
Budget and Planning Office
Office of the Governor
(Attn. State Clearinghouse)

Mailed:
Date: June 7, 1976

Date: Due: June 30, 1976

FROM: Dr. Charles G. Groat: B.E.G.

Refer: EIS-6-06-002

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT-PROPOSED 1976 OUTER CONTINENTAL SHELF OIL AND GAS LEASE SALE-GULF OF MEXICO -OCS SALE NO. 44

We have reviewed the cited document and our comments as to the adequacy of treatment of environmental effects of concern are shown below:

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JUL 3 1976
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| | Check (✓) for each item | |
|---|---|---|
| | [illegible] | Comment enclosed |
| 1. Additional specific effects which should be assessed: | ✓ | |
| 2. Additional alternatives which should be considered: | ✓ | |
| 3. Better or more appropriate measures and standards which should be used to evaluate environmental effects: | ✓ | |
| 4. Additional control measures which should be applied to reduce adverse environmental effects or to avoid or minimize the irreversible or irretrievable commitment of resources. | ✓ | |
| 5. Our assessment of how serious the environmental damage from this project might be, using the best alternative and control measures: | ✓ | |
| 6. We identify issues which require further discussion or resolution: | | ✓ |

☑ This agency concurs with the implementation of this project.

☐ This agency does not wish to comment on the subject document because:

C G Groat
Name & Title of Reviewing official
Acting Director

Enclosure(s)

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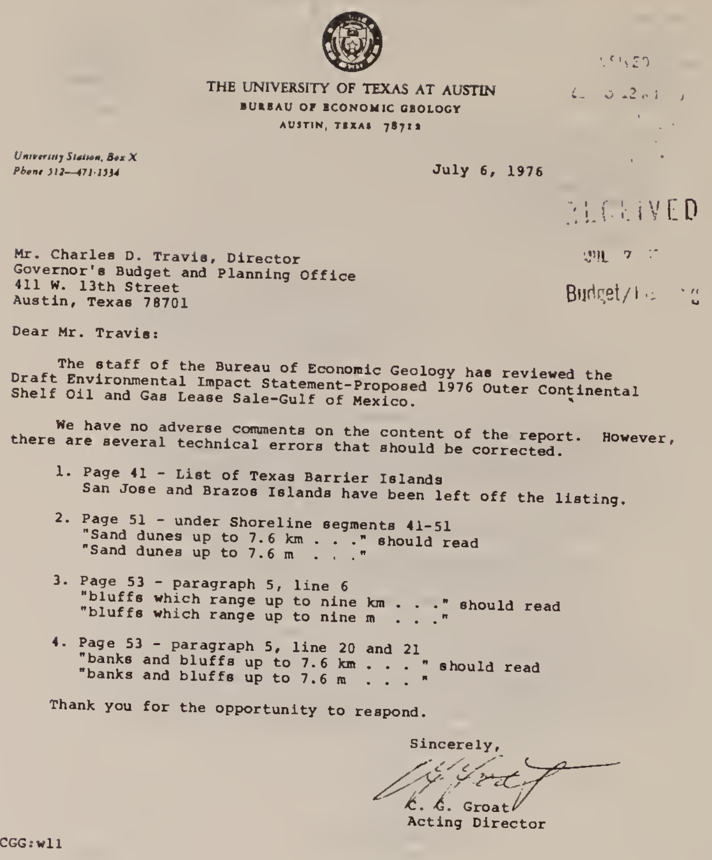

THE UNIVERSITY OF TEXAS AT AUSTIN
BUREAU OF ECONOMIC GEOLOGY
AUSTIN, TEXAS 78712

University Station, Box X
Phone 512—471-1534

July 6, 1976

RECEIVED
JUL 7
Budget/Planning

Mr. Charles D. Travis, Director
Governor's Budget and Planning Office
411 W. 13th Street
Austin, Texas 78701

Dear Mr. Travis:

The staff of the Bureau of Economic Geology has reviewed the Draft Environmental Impact Statement-Proposed 1976 Outer Continental Shelf Oil and Gas Lease Sale-Gulf of Mexico.

We have no adverse comments on the content of the report. However, there are several technical errors that should be corrected.

1. Page 41 - List of Texas Barrier Islands
   San Jose and Brazos Islands have been left off the listing.
2. Page 51 - under Shoreline segments 41-51
   "Sand dunes up to 7.6 km . . ." should read
   "Sand dunes up to 7.6 m . . ."
3. Page 53 - paragraph 5, line 6
   "bluffs which range up to nine km . . ." should read
   "bluffs which range up to nine m . . ."
4. Page 53 - paragraph 5, line 20 and 21
   "banks and bluffs up to 7.6 km . . . " should read
   "banks and bluffs up to 7.6 m . . . "

Thank you for the opportunity to respond.

Sincerely,

C G Groat
C. G. Groat
Acting Director

CGG:wll

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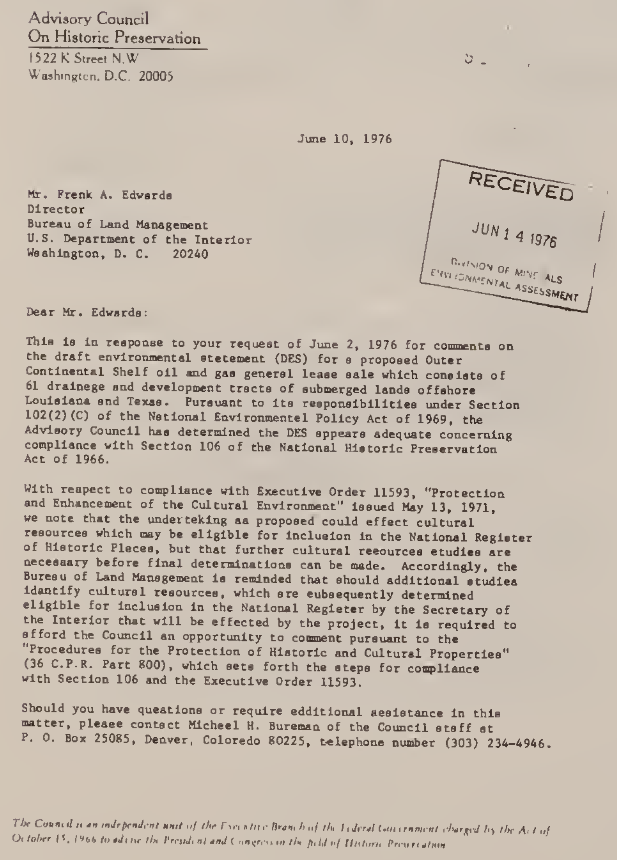

Advisory Council
On Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

June 10, 1976

RECEIVED
JUN 14 1976
DIVISION OF MINERALS
ENVIRONMENTAL ASSESSMENT

Mr. Frank A. Edwards
Director
Bureau of Land Management
U.S. Department of the Interior
Washington, D. C. 20240

Dear Mr. Edwards:

This is in response to your request of June 2, 1976 for comments on the draft environmental statement (DES) for a proposed Outer Continental Shelf oil and gas general lease sale which consists of 61 drainage and development tracts of submerged lands offshore Louisiana and Texas. Pursuant to its responsibilities under Section 102(2)(C) of the National Environmental Policy Act of 1969, the Advisory Council has determined the DES appears adequate concerning compliance with Section 106 of the National Historic Preservation Act of 1966.

With respect to compliance with Executive Order 11593, "Protection and Enhancement of the Cultural Environment" issued May 13, 1971, we note that the undertaking as proposed could effect cultural resources which may be eligible for inclusion in the National Register of Historic Places, but that further cultural resources studies are necessary before final determinations can be made. Accordingly, the Bureau of Land Management is reminded that should additional studies identify cultural resources, which are subsequently determined eligible for inclusion in the National Register by the Secretary of the Interior that will be effected by the project, it is required to afford the Council an opportunity to comment pursuant to the "Procedures for the Protection of Historic and Cultural Properties" (36 C.F.R. Part 800), which sets forth the steps for compliance with Section 106 and the Executive Order 11593.

Should you have questions or require additional assistance in this matter, please contact Michael H. Bureman of the Council staff at P. O. Box 25085, Denver, Colorado 80225, telephone number (303) 234-4946.

*The Council is an independent unit of the Executive Branch of the Federal Government charged by the Act of October 15, 1966 to advise the President and Congress in the field of Historic Preservation*

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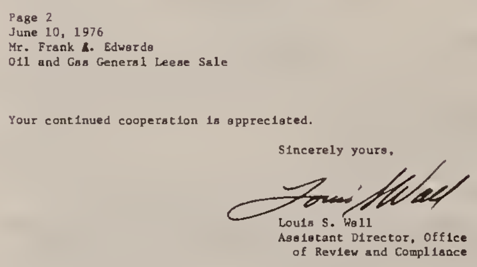

Page 2
June 10, 1976
Mr. Frank A. Edwards
Oil and Gas General Lease Sale

Your continued cooperation is appreciated.

Sincerely yours,

Louis Wall
Louis S. Wall
Assistant Director, Office
of Review and Compliance

SHELL OIL COMPANY
ONE SHELL SQUARE
P O BOX 60124
NEW ORLEANS, LOUISIANA 70160

OFFSHORE DIVISION

JUN 24 1976

Subject: OCS Sale No. 44
Offshore Central and
Western Gulf of Mexico

New Orleans Outer Continental Shelf Office
Bureau of Land Management
Hale Boggs Federal Building, Suite 841
500 Camp Street
New Orleans, Louisiana 70130

Gentlemen:

Shell Oil Company has reviewed the Draft Environmental Statement prepared by your office for the proposed OCS Sale No. 44. We support the leasing of these tracts and feel that the DES is adequate in light of the extensive drilling and producing operations that have already occurred in the areas of interest. However, we would like to offer a few comments regarding the discharge of mud and cuttings.

The BLM's statement that only ten percent of the mud used is discharged to the Gulf with the drill cuttings, when mud tanks are cleaned and prior to setting the conductor pipe, does not reflect the entire volume of drilling fluids disposed of in this manner. The attached discussion notes the volume of mud normally discharged in drilling a typical 10,000-foot and 18,000-foot exploratory well. Also, we question the statement that sodium lignosulfonate has replaced ferrochromelignosulfonate in a majority of the Gulf offshore mud systems.

Yours very truly,

L G Otteman

L. G. Otteman
Division Production Manager

Attachment

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## DRILLING MUD AND DRILLING CUTTINGS DISCHARGES

Two general types of exploratory wells have been analyzed - 10,000-foot and 18,000-foot. While these may not typify the anticipated productive horizons of OCS Sale No. 44 tracts, they do provide a range for comparative purposes. We would anticipate discharging drilling formation cuttings similar to dredge spoils amounting to 1530 cubic yards for the 10,000-foot wells and 2880 cubic yards for the deep wells. These cuttings are generated at the drill bit and brought to the surface by the drilling mud. Once at the surface, the cuttings are separated from the mud by fine screen shakers and centrifugal separators.

The first 150± feet will be drilled or jetted with seawater. The resulting seawater mud will be returned directly to the sea floor without being pumped to the rig. While drilling the hole to 1,000 feet, typically only seawater will be used as drilling fluid; and it will be discharged overboard. If the formation clays do not make a viscous enough mud, some natural bentonitic clay will be added to the system. The discharged water amounts to approximately 7,000 barrels, and it will contain mostly natural mud generated while drilling the hole. Before running the conductor pipe to 1,000 feet, approximately two tons of bentonite clay will be added to the 1,000-barrel saltwater system. When the conductor pipe is cemented, this volume of bentonite clay in seawater will be discharged overboard.

While drilling the remainder of the hole, the mud is continuously cycled back through the mud system. Some mud is discharged with the drill cuttings; and periodically, drilling mud is discharged overboard to make room for natural mud made while drilling the hole. This periodic discharge averages 500 barrels a day; therefore, during approximately 20 days of drilling to 10,000 feet, some 10,000 barrels of bentonite clay and lignosulfonate treated mud would be discharged overboard. We would possibly begin converting the mud system from a seawater gel mud to a lignosulfonate treated freshwater mud at around 6,000 feet. This decision would be based on the relative economics of hauling freshwater from shore versus the higher maintenance cost of saltwater muds. During the additional 70 days operations while drilling from 10,000 to 18,000 feet, approximately 20,000 barrels of lignosulfonate drilling mud would be dumped overboard. When the well is completed, the mud remaining in the surface system is discharged overboard; and this can amount to as much as 800 barrels. The typical composition of gelled seawater and lignosulfonate treated muds are given on the following pages.

---

## TYPICAL MUD COMPOSITION - SEAWATER GEL MUD

This type mud is typically used to drill from the base of the conductor casing to the surface casing point. Generally, the seawater gel system will be used from less than 1000 feet to a maximum of 4500 feet. The components used to make up and maintain the required characteristics of this mud system are:

| Mud Components | Lbs/Bbl of Mud |
|---|---|
| 1. Drilled Solids | 48-60 |
| 2. Bentonitic Clay | 30-40 |
| 3. Caustic - Sodium Hydroxide | 0.5-1.5 |
| 4. Mica Flakes (Lost Circulation Material) | 0.0-.5 |
| 5. Cellulose Polymer | 0.0-.25 |
| 6. Seawater | As required - approx 10#/bbl salt from the sea water |

## LIGHTLY TREATED LIGNOSULFONATE SEAWATER/FRESHWATER (6,000-8,000 ppm $Cl^-$) MUD

As the hole is deepened below surface casing it becomes necessary to start adding additional materials to maintain the desired mud characteristics. Slowly fresh water is substituted for sea water as the depth and temperature increase. A typical 10.0-10.5 pound per gallon lightly treated lignosulfonate system used to about 10,000 feet would include:

| Mud Components | Lbs/Bbl of Mud |
|---|---|
| 1. Drilled Solids | 55-70 |
| 2. Bentonitic Clay | 20-30 |
| 3. Barium Sulfate - Weight Material | 45-60 |
| 4. Caustic - Sodium Hydroxide | 1.0-2.0 |
| 5. Lignosulfonate | 4-6 |
| 6. Lignite | 0.0-3.0 |
| 7. Cellulose Polymer | 0.0-.25 |
| 8. Seawater/Freshwater | As required - approx 5#/bbl salt from 50/50 seawater-freshwater |

## LIGNOSULFONATE FRESHWATER (3,000-4,000 ppm $Cl^-$) MUD

The deep portion of a typical well (below approximately 10,000 ft.) would require a freshwater lignosulfonate mud system in order to maintain the mud properties as desired for proper hole maintenance. A typical 10.0-11.0 pound per gallon lignosulfonate treated mud system would include:

---

| Mud Components | Lbs/Bbl of Mud |
|---|---|
| 1. Drilled Solids | 65-80 |
| 2. Bentonitic Clay | 20-30 |
| 3. Barium Sulfate - Weight Material | 55-150 |
| 4. Caustic Sodium Hydroxide | 1-2 |
| 5. Lignosulfonate | 4-8 |
| 6. Lignite | 3-8 |
| 7. Defoamer/Detergents | 0.5 |
| 8. Fresh water | As Required |

VOLUME OF DRILL CUTTINGS GENERATED AND DRILLING MUDS

| WELL TYPE | HOLE SIZE INCHES 10,000 FT | HOLE SIZE INCHES 18,000 FT | CUTTING VOLUME $YD^3$ 10,000 FT | CUTTING VOLUME $YD^3$ 18,000 FT | WEIGHT OF CUTTINGS REMOVED FROM HOLE TONS 10,000 FT | WEIGHT OF CUTTINGS REMOVED FROM HOLE TONS 18,000 FT | TOTAL MUD VOLUME (INCL. HOLE VOLUME) BBLS 10,000 FT | TOTAL MUD VOLUME (INCL. HOLE VOLUME) BBLS 18,000 FT | DRILLING MUD TYPE |
|---|---|---|---|---|---|---|---|---|---|
| INTERVAL BELOW MUDLINE | | | | | | | | | |
| 0-150 | 36 | 36 | 118 | 118 | 72 | 72 | As required | | Seawater and natural mud |
| 150-1,000 | 25 | 32 | 322 | 527 | 203 | 332 | As required | | Seawater-gel natural mud .. |
| 1,000-4,500 | 18 | 20 | 465 | 848 | 303 | 553 | 1800 | 2200 | Seawater-gel Lightly treated mud |
| 4,500-10,000 | 11 | - | 404 | - | 272 | - | 1600 | - | Seawater/fresh-water - lignosulfonate mud |
| 4,500-12,000 | - | 15 | - | 1023 / | - | 690 | - | 2800 | Seawater/fresh-water - lignosulfonate mud |
| 12,000-18,000 | - | 10 | - | 364 | - | 263 | - | 2000 | Freshwater lignosulfonate mud |
| | | TOTAL | 1530 $YD^3$ | 2880 $YD^3$ | 850 TONS | 1910 TONS | | | |

## Public Hearing Log

Witnesses at Public Hearing

PROPOSED OCS SALE 44

Texas and Louisiana

REGISTRATION AND PROPOSED LIST OF SPEAKERS

Hearing July 7, 1976

1. Kenneth F. Keller, Division Manager, Mobile Oil Company.
2. Offshore Operators Committee, Wm. M. Meyers, Attorney—Liskow & Lewis; Claude F. Golay, Chevron Oil Company.
3. W. M. Chappelle, Exxon Company, USA.

Comments received after Public Hearing

1. J. M. Otts, Jr., Gulf Energy & Minerals Co.
2. J. R. Place, Cities Service Oil Co.
3. J. H. Moss, Jr., Southern Natural Gas Co.
4. W. H. Baker, Skelly Oil Co.
5. R. S. Hoogland, U.S. Dept. of Commerce, NOAA.
6. NMFS.

## Written Comments Received

List of Written Comments received on Draft Environmental Statement on Proposed Outer Continental Shelf Oil and Gas Lease Sale Offshore Gulf of Mexico (OCS Sale No. 44)

| Date of Comment | Organization Represented |
|---|---|
| 3-15-76 | State of La. Mineral Board |
| 4-26-76 | Dept. of Commerce, NOAA, NMFS-Science/Technology |
| 4-30-76 | U.S. Fish and Wildlife Service |
| 4-30-76 | U.S. Geological Survey (Metairie, La.) |
| 5-13-76 | Texas Budget and Planning Office |
| 5-13-76 | Texas Water Rights Commission |
| 5-13-76 | Texas Parks and Wildlife Dept. |
| 5-13-76 | Texas Division of Planning Coordination State Clearinghouse |
| 5-13-76 | Texas Water Quality Board |
| 5-13-76 | General Land Office, Texas |
| 5-13-76 | University of Texas at Austin, Bureau of Economic Geology |
| 6-17-76 | State of Louisiana, Commission of Intergovernmental Relations |
| 6-18-76 | Advisory Council on Historic Preservation |
| 6-21-76 | Nuclear Regulatory Commission |
| 6-21-76 | State of Louisiana, Wildlife and Fisheries Commission |
| 6-25-76 | Shell Oil Co. |
| 7-2-76 | Texas Water Rights Commission |
| 7-6-76 | Federal Power Commission, Bureau of Natural Gas |
| 7-8-76 | Louisiana State Parks and Recreation Commission |
| 7-8-76 | Bureau of Outdoor Recreation |
| 7-13-76 | Bureau of Mines |
| 7-16-76 | Department of Transportation, Materials Transportation Bureau |
| 7-22-76 | Texas Budget and Planning Office |
| 7-22-76 | Department of Transportation, U.S. Coast Guard |
| 7-28-76 | U.S. Dept. of Commerce, Assistant Secretary for Science and Technology |
| 8-2-76 | U.S. Geological Survey (Reston, Va.) |
| 8-3-76 | Department of the Army, U.S. Corps of Engineers, New Orleans |
| 8-6-76 | U.S. Environmental Protection Agency |
| 8-6-76 | Marine Mammal Commission |

# BIBLIOGRAPHY

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# APPENDIX A

# LIST OF TRACTS PROPOSED FOR LEASING IN SALE NO. 44

# XI APPENDIX

## APPENDIX A

### List of Tracts for Proposed Lease Sale #44

| Tract Number | Block | Description | Type/ Res. | Acreage | Distance From Shore (S.Miles) | Water Depth (Meters) |
|---|---|---|---|---|---|---|
| Brazos Area, South Addition (BS) | | | | | | |
| 1 | A-104 | All | II/G | 5760 | 22 | 57 |
| Galveston Area (G) | | | | | | |
| 2 | 144 | All | II/G | 5760 | 11 | 14 |
| High Island Area (HI) | | | | | | |
| 3 | 109 | All | I/O&G | 5760 | 14 | 14 |
| 4 | 141 | E½ | I/G | 2880 | 15 | 15 |
| High Island Area, East Addition (HIE) | | | | | | |
| 5 | A-228 | All | II/G | 5760 | 34 | 27 |
| High Island Area, East Addition, South Extension (HES) | | | | | | |
| 6 | A-281 | All | II/G | 5760 | 44 | 52 |
| 7 | A-310 | All | II/G | 2908 | 50 | 64 |
| West Cameron Area (WC) | | | | | | |
| 8 | 69 | S½ | I/G | 2500 | 9 | 11 |
| 9 | 103 | All | I/G | 5000 | 12 | 12 |
| 10 | 134 | E½ | I/G | 2500 | 18 | 12 |
| 11 | 170 | E½ | I/G | 2500 | 22 | 11 |
| 12 | 264 | All | II/G | 5000 | 42 | 24 |
| 13 | 279 | All | I/G | 5000 | 48 | 27 |
| West Cameron Area, South Addition (WCS) | | | | | | |
| 14 | 455 | All | II/G | 5000 | 67 | 36 |
| 15 | 459 | All | II/G | 5000 | 64 | 39 |
| 16 | 460 | All | II/G | 5000 | 71 | 39 |
| 17 | 506 | All | I/G | 5000 | 77 | 43 |
| 18 | 507 | S½ | I/G | 2500 | 79 | 46 |
| 19 | 528 | All | I/G | 5000 | 90 | 54 |
| 20 | 539 | All | I/G | 5000 | 98 | 75 |
| 21 | 601 | All | II/G | 5000 | 109 | 78 |

| Tract Number | Block | Description | Type/ Res. | Acreage | Distance from Shore (S.Miles) | Water Depth (Meters) |
|---|---|---|---|---|---|---|
| East Cameron Area, South Addition (ECS) | | | | | | |
| 22 | 333 | All | II/G | 5000 | 100 | 75 |
| 23 | 336 | All | II/G | 5000 | 103 | 78 |
| 24 | 340 | All | I/G | 5000 | 101 | 78 |
| Vermilion Area (V) | | | | | | |
| 25 | 25 | All | I/G | 5000 | 5 | 8 |
| 26 | 37 | All | I/G | 5000 | 7 | 11 |
| 27 | 50 | All | I/G | 4605.36 | 8 | 5 |
| 28 | 102 | All | II/G | 4587.70 | 24 | 20 |
| 29 | 146 | All | I/G | 5000 | 32 | 24 |
| 30 | 156 | All | I/G | 5000 | 34 | 25 |
| 31 | 160 | SW¼ | I/G | 1250 | 35 | 27 |
| 32 | 163 | NW¼ | I/G | 1250 | 38 | 28 |
| Vermilion Area, South Addition (VS) | | | | | | |
| 33 | 277 | All | II/G | 5000 | 76 | 55 |
| 34 | 286 | All | II/G | 5000 | 78 | 57 |
| 35 | 310 | All | I/G | 5000 | 83 | 63 |
| South Marsh Island Area (SMI) | | | | | | |
| 36 | 8 | All | I/O&G | 3146.45 | 30 | 20 |
| South Marsh Island Area, South Addition (SMS) | | | | | | |
| 37 | 183 | All | I/G | 3509.89 | 98 | 114 |
| South Marsh Island Area, North Addition (SMN) | | | | | | |
| 38 | 273 | All | II/G | 5000 | 27 | 12 |
| 39 | 276 | All | II/G | 5000 | 32 | 15 |
| Eugene Island Area (EI) | | | | | | |
| 40 | 37 | 1/ | I/G | 419.13 | 3 | 3 |
| 41 | 229 | All | I/G | 5000 | 40 | 37 |
| Eugene Island Area, South Addition (EIS) | | | | | | |
| 42 | 301 | N½ | II/G | 2500 | 62 | 61 |
| 43 | 302 | All | II/G | 5000 | 62 | 67 |
| 44 | 310 | All | II/O&G | 5000 | 62 | 68 |
| 45 | 311 | All | II/O&G | 5000 | 70 | 67 |
| 46 | 351 | All | II/G | 5000 | 72 | 90 |
| 47 | 352 | All | II/G | 5000 | 72 | 86 |

| Tract Number | Block | Description | Type/ Res. | Acreage | Distance from Shore (S. Miles) | Water Depth (Meters) |
|---|---|---|---|---|---|---|
| Ship Shoal Area (SS) | | | | | | |
| 48 | 15 | 1/ | I/G | 1311.12 | 3 | 3 |
| 49 | 36 | NW¼ | I/G | 1250 | 3 | 3 |
| 50 | 111 | All | II/G | 5000 | 17 | 10 |
| 51 | 213 | All | I/O&G | 5000 | 32 | 33 |
| 52 | 232 | All | I/O&G | 5000 | 34 | 38 |
| South Timbalier Area (ST) | | | | | | |
| 53 | 182 | All | I/O&G | 2148.46 | 33 | 38 |
| West Delta Area (WD) | | | | | | |
| 54 | 34 | N½ | I/O&G | 2500 | 10 | 18 |
| 55 | 47 | All | I/O&G | 5000 | 10 | 13 |
| South Pass Area (SP) | | | | | | |
| 56 | 57 | 2/ | I/O | 877.84 | 4 | 55 |
| Main Pass Area (MP) | | | | | | |
| 57 | 72) | 2/ | | | 6 | 36 |
| | 74) | 2/ | I/O | 3382.43 | 5 | 43 |
| 58 | 114 | All | II/G | 4994.55 | 11 | 16 |
| 59 | 116 | All | II/G | 4994.55 | 11 | 15 |
| Main Pass Area, South & East Addition (MSE) | | | | | | |
| 60 | 160 | All | II/G | 4994.55 | 21 | 37 |
| Mobile South No. 2 (MS2) | | | | | | |
| 61 | N658 E47 | All | I/G | 2178.08 | 31 | 200 |

1/ That portion located three nautical miles seaward of the baseline of June 16, 1975 (U.S. vs Louisiana, 422 U.S. 13).

2/ That portion of South Pass block 57 and Main Pass blocks 72 and 74 located three nautical miles seaward of the baseline of June 16, 1975 (U.S. vs Louisiana, 422 U.S. 13) to one foot seaward of the Third Supplemental Decree Line (404 U.S. 388 (December 20, 1971)).

Key to Type/Reservoir:

Type I - drainage tract, Type II - development tract and Type III - wildcat tract.

Reservoir: G-gas, O-oil and O&G-oil and gas.

# APPENDIX B

# ORDERS 1 THROUGH 13 GOVERNING OIL, GAS AND SULPHUR LEASES IN THE OUTER CONTINENTAL SHELF, GULF OF MEXICO AREA AND GUIDELINES TO OCS ORDER NO. 14

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

# OCS ORDER NO. 1

*Effective August 28, 1969*

## MARKING OF WELLS, PLATFORMS, AND FIXED STRUCTURES

This order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.37. Section 250.37 provides as follows:

> *Well designations.* The lessee shall mark promptly each drilling platform or structure in a conspicuous place, showing his name or the name of the operator, the serial number of the lease, the identification of the wells, and shall take all necessary means and precautions to preserve these markings.

The operator shall comply with the following requirements. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *Identification of Platforms, Fixed Structures.* Platforms and structures, other than individual wellhead structures and small structures, shall be identified at two diagonal corners of the platform or structure by a sign with letters and figures not less than 12 inches in height with the following information: The name of lease operator, the name of the area, the block number of the area in which the platform or structure is located, and the platform or structure designation. The information shall be abbreviated as in the following example:

> "The Blank Oil Company operates 'C' platform in Block 37 of South Timbalier Area."

The identifying sign on the platform would show:

> "BOC - S.T. - 37 - C."

2. *Identification of Single Well Structures and Small Structures.* Single well and small structures may be identified with one sign only, with letters and figures not less than 3 inches in height. The information shall be abbreviated as in the following example:

> "The Blank Oil Company operates well No. 1 which is equipped with a protective structure, in Block 68 in the East Cameron Area."

The identifying sign on the protective structure would show:

> "BOC - E.C. - 68 - No. 1"

3. *Identification of Wells.* The OCS lease and well number shall be painted on, or a sign affixed to, each singly completed well. In multiple completed wells each completion shall be individually identified at the well head. All identifying signs shall be maintained in a legible condition.

/s/ ROBERT F. EVANS
*Supervisor*

APPROVED: AUGUST 28, 1969

/s/ RUSSELL G. WAYLAND
*Chief, Conservation Division*

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

# OCS ORDER NO. 2

*Effective January 1, 1975*

## DRILLING PROCEDURES

This Order is established pursuant to the authority prescribed in 30 CFR 250.11. All exploratory and development wells drilled for oil and gas shall be drilled in accordance with 30 CFR 250.34, 250.41, 250.91, and the provisions of this Order which shall continue in effect until field drilling rules are issued. When sufficient geologic and engineering information is obtained through exploratory drilling, operators may make application or the Area Supervisor may require an application for the establishment of field drilling rules. After field drilling rules have been established by the Area Supervisor, development wells shall be drilled in accordance with such rules.

All wells drilled under the provisions of this Order shall have been included in an exploratory or development plan for the lease as required under 30 CFR 250.34. Each application for Permit to Drill (Form 9-331C) shall include all information required under 30 CFR 250.91, and shall include a notation of any proposed departures from the requirements of this Order. All departures from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 250.12(b).

The operator shall comply with the following requirements. All applications for approval under the provisions of this Order shall be submitted to the appropriate District Supervisor.

1. *Well Casing and Cementing.* All wells shall be cased and cemented in accordance with the requirements of 30 CFR 250.41(a)(1), and the Application for Permit to Drill shall include the casing design safety factors for collapse, tension, and burst. In cases where cement has filled the annular space back to the Gulf floor, the cement may be washed out or displaced to a depth not exceeding 40 feet below the Gulf floor to facilitate casing removal upon well abandonment. For the purpose of this Order, the several casing strings in order of normal installation are drive or structural, conductor, surface, intermediate, and production casing.

The design criteria for all wells shall consider all pertinent factors for well control, including formation fracture gradients and pressures and casing setting depths such that the well bore could be expected to withstand a pressure equivalent to at least a 0.5-ppg kick. All casing, except drive pipe, shall be new pipe or reconditioned used pipe that has been tested to insure that it will meet API standards for new pipe.

A. *Drive or Structural Casing.* This casing shall be set by drilling, driving, or jetting to a minimum depth of 100 feet below the Gulf floor or to such greater depth required to support unconsolidated deposits and to provide hole stability for initial drilling operations. If this portion of the hole is drilled, the drilling fluid shall be of a type that is in compliance with the liquid disposal requirements of OCS Order No. 7, and a quantity of cement sufficient to fill the annular space back to the Gulf floor shall be used.

B. *Conductor and Surface Casing.* Casing design and setting depths shall be based upon all engineering and geologic factors, including the presence or absence of hydrocarbons or other potential hazards and water depths.

(1) *Conductor Casing.* This casing shall be set at a depth in accordance with paragraph 1B(3) below. A quantity of cement sufficient to fill the annular space back to the Gulf floor shall be used.

(2) *Surface Casing.* This casing shall be set at a depth in accordance with paragraph 1B(3) below and cemented in a manner necessary to protect all freshwater sands and provide well control until the next string of casing is set.

This casing shall be cemented with a quantity sufficient to fill the calculated annular space to at least 1,500 feet above the surface casing shoe and at least 100 feet inside the conductor casing or as approved by the District Supervisor. When there are indications of improper cementing, such as lost return, cement channeling, or mechanical failure of equipment, the operator shall recement or make the necessary repairs. After drilling a maximum of 100 feet below the surface casing shoe, a pressure test shall be obtained to aid in determining a formation fracture gradient either by testing to formation leak-off or by testing to a predetermined equivalent mud weight. The results of this test and any subsequent tests of the formation shall be recorded on the driller's log and used to determine the depth and maximum mud weight of the intermediate hole.

(3) *Conductor and Surface Casing Setting Depths*. These strings of casing shall be set at the depth specified below, subject to approved variation to permit the casing to be set in a competent bed, or through formations determined desirable to be isolated from the well by pipe for safer drilling operations, provided, however, that the conductor casing shall be set immediately prior to drilling into formations known to contain oil or gas, or, if unknown, upon encountering such formations. These casing strings shall be run and cemented prior to drilling below the specified setting depths. For those wells which may encounter abnormal pressure conditions, the District Supervisor may prescribe the exact setting depth. Conductor casing setting depths shall be between 500 feet and 1,000 feet (TVD below Gulf floor).

Engineering and geologic data used to substantiate the proposed setting depths of the conductor and surface casing (such as estimated fracture gradients, pore pressures, shallow hazards, etc.) shall be furnished with the Application for Permit to Drill.

C. *Intermediate Casing*. This string of casing shall be set when required by anticipated abnormal pressure, mud weight, sediment, and other well conditions. The proposed setting depth for intermediate casing will be based on the pressure tests of the exposed formation below the surface casing shoe.

A quantity of cement sufficient to cover and isolate all hydrocarbon zones and to isolate abnormal pressure intervals from normal pressure intervals shall be used. If a liner is used as an intermediate string, the cement shall be tested by a fluid entry or pressure test to determine whether a seal between the liner top and next larger string has been achieved. The test shall be recorded on the driller's log. When such liner is used as production casing, it shall be extended to the surface and cemented to avoid surface casing being used as production casing.

D. *Production Casing*. This string of casing shall be set before completing the well for production. It shall be cemented in a manner necessary to cover or isolate all zones which contain hydrocarbons, but in any case, a calculated volume sufficient to fill the annular space at least 500 feet above the uppermost producible hydrocarbon zone must be used. When a liner is used as production casing, the testing of the seal between the liner top and the next larger string shall be conducted as in the case of intermediate liners. The test shall be recorded on the driller's log.

E. *Pressure Testing*. Prior to drilling the plug after cementing, all casing strings, except the drive or structural casing, shall be pressure-tested as shown in the table below. The test pressure shall not exceed the internal yield pressure of the casing. The surface casing shall be tested with water in the top 100 feet of the casing. If the pressure declines more than 10 percent in 30 minutes, or if there is other indication of a leak, the casing shall be recemented, repaired, or an additional casing string run, and the casing shall be tested again in the same manner.

| *Casing* | *Minimum Surface Pressure* |
|---|---|
| *Conductor* | 200 |
| *Surface* | 1,000 |
| *Intermediate* | 1,500 or 0.2 psi/ft., whichever is greater. |
| *Liner* | 1,500 or 0.2 psi/ft., whichever is greater. |
| *Production* | 1,500 or 0.2 psi/ft., whichever is greater. |

After cementing any of the above strings, drilling shall not be commenced until a time lapse of eight hours under pressure for conductor casing string or 12 hours under pressure for all other strings. Cement is considered under pressure if one or more float valves are employed and are shown to be holding the cement in place or when other means of holding pressure is used. All casing pressure tests shall be recorded on the driller's log.

F. *Directional Surveys*. Wells are considered vertical if inclination does not exceed an average of three degrees from the vertical. Inclination surveys shall be obtained on all vertical wells at intervals not exceeding 1,000 feet during the normal course of drilling.

Wells are considered directional if inclination exceeds an average of three degrees from the vertical. Directional surveys giving both inclination and azimuth shall be obtained on all directional wells at intervals not exceeding 500 feet during the normal course of drilling and at intervals not exceeding 100 feet in all angle change portions of the hole.

On both vertical and directional wells, directional surveys giving both inclination and azimuth shall be obtained at intervals not exceeding 500 feet prior to, or upon, setting surface or intermediate casing, liners, and at total depth.

Composite directional surveys shall be filed with the District Supervisor. The interval shown will be from the bottom of conductor casing, or, in the absence of conductor casing, from the bottom of drive or structural casing to total depth. In calculating all surveys, a correction from true north to Lambert-Grid north shall be made after making the magnetic to true north correction.

2. *Blowout Prevention Equipment.* Blowout preventers and related well-control equipment shall be installed, used, and tested in a manner necessary to prevent blowouts. Prior to drilling below the drive pipe or structural casing and until drilling operations are completed, blowout prevention equipment shall be installed and maintained ready for use as follows:

A. *Drive Pipe or Structural Casing.* Before drilling below this string, at least one remotely controlled, annular-type blowout preventer or pressure-rotating, pack-off-type head and equipment for circulating the drilling fluid to the drilling structure or vessel shall be installed. When the blowout preventer system is on the Gulf floor, the choke and kill lines or equivalent vent lines, equipped with necessary connections and fittings, shall be used for diversion. An annular preventer or pressure-rotating, pack-off-type head, equipped with suitable diversion lines as described above and installed on top of the marine riser, to permit the diversion of hydrocarbons and other fluids, may be utilized for diversion. A diverter system which provides at least the equivalent of two 4-inch lines (22 square inches internal cross-sectional area) and full-open or butterfly valves shall be installed in order to permit the full diversion of hydrocarbons and other fluids. The diverter system shall be equipped with automatic, remote-controlled valves which open, prior to shutting in the well, at least two lines venting in different directions to accomplish downwind diversion. A schematic diagram and operational procedure for the diverter system shall be submitted with the Application for Permit to Drill (Form 9-331C) to the District Supervisor for approval.

In drilling operations where a floating drill ship or semisubmersible type of drilling vessel is used, and/or where the placement of the initial structural casing is not operationally feasible to provide adequate formation competence to subsequently safely contain shallow hydrocarbons or other fluids while drilling conductor hole, a program which provides for rig and personnel protection and safety in these operations shall be described and submitted to the District Supervisor for his consideration and approval. This program shall include all known pertinent and relevant information, including seismic and geologic data, water depth, drilling-fluid hydrostatic pressure, schematic diagram from rotary table to proposed conductor casing seat, and contingency plan for moving off location. In all areas where shallow hazards or hydrocarbons are unknown, seismic data shall be obtained, and a small-diameter initial pilot hole from the bottom of drive or structural casing to proposed conductor casing seat shall be drilled to determine the presence or absence of these hazards.

B. *Conductor Casing.* Before drilling below this string, at least one remotely controlled, annular-type blowout preventer and equipment for circulating the drilling fluid to the drilling structure or vessel shall be installed. A diverter system as described in paragraph 2A above shall be installed.

C. *Surface Casing.* Before drilling below this string, the blowout prevention equipment shall include a minimum of: (1) three remote-controlled, hydraulically operated blowout preventers with a working pressure which exceeds the maximum anticipated surface pressure, including one equipped with pipe rams, one with blind rams, and one annular type; (2) a drilling spool with side outlets, if side outlets are not provided in the blowout preventer body; (3) a choke line and manifold; (4) a kill line separate from choke line; and (5) a fill-up line.

D. *Intermediate Casing.* Before drilling below this string, the blowout prevention equipment shall include a minimum of: (1) four remote-controlled, hydraulically operated blowout preventers with a working pressure which exceeds the maximum anticipated surface pressure, including at least two equipped with pipe rams, one with blind rams, and one annular type; (2) a drilling spool with side outlets, if side outlets are not provided in the blowout preventer body; (3) a choke line and manifold; (4) a kill line separate from choke line; and (5) a fill-up line.

E. *Testing.*

(1) *Pressure Test.* Ram-type blowout preventers and related control equipment shall be tested with water to the rated working pressure of the stack assembly, with the exception of the annular-type preventer, which shall be tested to 70 percent of the rated working pressure. They shall be tested: (a) when installed, (b) before drilling out after each string of casing is set, (c) not less than once each week from each of the control stations, and (d) following repairs that require disconnecting a pressure seal in the assembly.

(2) *Actuation.* While drill pipe is in use, ram-type blowout preventers shall be actuated to test proper functioning once each trip, but in no event less than once each day. The annular-type blowout preventer shall be actuated on the drill pipe once each week. Accumulators or accumulators and pumps shall maintain a pressure capacity reserve at all times to provide for repeated operation of hydraulic preventers. An operable remote blowout-preventer-control station shall be provided, in addition to the one on the drilling floor.

(3) *Drills.* A blowout prevention drill shall be conducted weekly for each drilling crew to insure that all equipment is operational and that crews are properly trained to carry out emergency duties.

(4) *Records.* All blowout preventer tests and crew drills shall be recorded on the driller's log.

F. *Other Equipment.* An inside blowout-preventer assembly (back-pressure valve) and an essentially full-opening drill-string safety valve in the open position shall be maintained on the rig floor to fit all pipe in the drill string. A kelly cock shall be installed below the swivel, and an essentially full-opening kelly cock of such design that it can be run through the blowout preventers shall be installed at the bottom of the kelly.

3. *Mud Program.* The characteristics, use, and testing of drilling mud and the conduct of related drilling procedures shall be such as are necessary to prevent the blowout of any well. Quantities of mud materials sufficient to insure well control shall be maintained readily accessible for use at all times.

A. *Mud Control.* Before starting out of the hole with drill pipe, the mud shall be properly conditioned. Proper conditioning requires either circulation with the drill pipe just off bottom to the extent that the annular volume is displaced, or proper documentation in the driller's log prior to pulling the drill pipe that: (1) there was no indication of influx of formation fluids prior to starting to pull the drill pipe from the hole, (2) the weight of the returning mud is not less than the weight of the mud entering the hole, and (3) other mud properties recorded on the daily drilling log are within the specified ranges at the stage of drilling the hole to perform their required functions. In those cases when the hole is circulated, the driller's log shall be so noted.

When coming out of the hole with drill pipe, the annulus shall be filled with mud before the mud level drops 100 feet. A mechanical device for measuring the amount of mud required to fill the hole shall be utilized, and any time there is an indication of swabbing, or influx of formation fluids, the necessary safety devices and action shall be employed to control the well. The mud shall not be circulated and conditioned, except on or near bottom, unless well conditions prevent running the drill pipe back to bottom. The mud in the hole shall be circulated or reverse-circulated prior to pulling drill-stem test tools from the hole.

The hole shall be filled by accurately measured volumes of mud. The number of stands of drill pipe and drill collars that may be pulled between the times of filling the hole shall be calculated and posted. The number of barrels and pump strokes required to fill the hole for this designated number of stands of drill pipe and drill collars shall be posted. For each casing string, the maximum pressure which may be applied to the blowout preventer before controlling excess pressure by bleeding through the choke shall be posted near the driller. Drill pipe pressure shall be monitored during the bleeding procedure for well control.

An operable degasser shall be installed in the mud system prior to the commencement of drilling operations and shall be maintained for use throughout the drilling and completion of the well.

B. *Mud Test Equipment.* Mud test equipment shall be maintained on the drilling rig at all times, and mud tests shall be performed daily, or more frequently as conditions warrant. The following mud-system monitoring equipment shall be installed (with derrick floor indicators) and used at the point in the drilling operation when mud returns are established and throughout subsequent drilling operations:

(1) Recording mud pit level indicator to determine mud pit volume gains and losses. This indicator shall include a visual and audio warning device.

(2) Mud volume measuring device for accurately determining mud volumes required to fill the hole on trips.

(3) Mud return indicator to determine that returns essentially equal the pump discharge rate.

(4) Gas-detecting equipment to monitor the drilling mud returns.

C. *Mud Quantities*. Daily inventories of mud materials, including barite, shall be recorded to provide a basis for determining minimum quantities needed for emergency use. Drilling operations shall be suspended in the absence of minimum quantities of mud materials for emergency use.

4. *Well Control Surveillance and Training*

A. *Surveillance*. From the time drilling operations are initiated and until the well is completed or abandoned, a member of the drilling crew or the toolpusher shall maintain rig floor surveillance at all times, unless the well is secured with blowout preventers or cement plugs.

B. *Training*. Company and drilling-contractor supervisory personnel shall be trained in and knowledgeable of present-day well control. The operator shall maintain a record of such training on the facility. Training shall include:

(1) Abnormal pressure detection methods.

(2) Well control operations, including kicks, lost circulation, and trips.

5. *Hydrogen Sulfide*. When drilling operations are undertaken to penetrate reservoirs known or expected to contain hydrogen sulfide ($H_2S$), or, if unknown, upon encountering $H_2S$, the following preventive measures shall be taken to control the effects of the toxicity, flammability, and corrosive characteristics of $H_2S$. Alternative equipment or procedures that achieve the same or greater levels of safety may be approved by the District Supervisor. When sulphur dioxide ($SO_2$), a product of combustion of $H_2S$, is present, the procedures outlined in the approved contingency plan required in paragraph 5a(3) of this Order shall be followed.

A. *Personnel Safety and Protection*.

(1) *Training Program*.

(a) All personnel, whether regularly assigned, contracted, or employed on an unscheduled basis, shall be informed as to the hazards of $H_2S$ and $SO_2$. They shall also be instructed in the proper use of personnel safety equipment and informed of $H_2S$ detectors and alarms, ventilation equipment, prevailing winds, briefing areas, warning systems, and evacuation procedures.

(b) Information relating to these safety measures shall be prominently posted on the drilling facility and on vessels in the immediate vicinity which are serving the drilling facility.

(c) To promote efficient safety procedures, an on-site $H_2S$ safety program, which includes a weekly drill and training session, shall be established. Records of attendance shall be maintained on the drilling facility.

(d) All personnel in the working crew shall have been indoctrinated in basic first-aid procedures applicable to victims of $H_2S$ exposure. During subsequent on-site training sessions and drills, emphasis shall be placed upon rescue and first aid for $H_2S$ victims. Each drilling facility shall have the following equipment, and each crew member shall be thoroughly familiar with the location and use of these items:

(i) A first-aid kit.

(ii) Resuscitators, complete with face masks, oxygen bottles, and spare oxygen bottles.

(iii) A Stokes litter or equivalent.

(e) One person, who regularly performs duties on the drilling facility, shall be responsible for the overall operation of the on-site safety and training program.

(2) *Visible Warning System*. Wind direction equipment shall be installed at prominent locations to indicate to all personnel, on or in the immediate vicinity of the facility, the wind direction at all times for determining safe upwind areas in the event that $H_2S$ is present in the atmosphere.

Operational danger signs shall be displayed from each side of the drilling ship or platform, and a number of rectangular red flags shall be hoisted in a manner visible to watercraft and aircraft. Each flag shall be of a minimum width of three feet and a minimum height of two feet. Each sign shall have a minimum width of eight feet and a minimum height of four feet, and shall be painted a high-visibility yellow color with black lettering of a minimum of 12 inches in height, indicating: "DANGER—HYDROGEN SULFIDE—$H_2S$". All signs and flags shall be illuminated under conditions of poor visibility and at night when in use. These signs and flags shall be displayed to indicate the following operational conditions and requirements:

(a) Moderate Danger. When the threshold limit value of $H_2S$ (10 parts per million) is reached, the signs will be displayed. If the concentration of $H_2S$ reaches 20 parts per million, protective breathing apparatus shall be worn by all personnel, and all nonworking personnel shall proceed to the safe briefing areas.

(b) Extreme Danger. When $H_2S$ is determined to have reached the injurious level (50 parts per million), the flags shall be hoisted in addition to the displayed signs. All nonessential personnel or all personnel, as appropriate, shall be evacuated at this time. Radio communications shall be used to alert all known air- and watercraft in the immediate vicinity of the drilling facility.

(3) *Contingency Plan.* A contingency plan shall be developed prior to the commencement of drilling operations. The plan shall include the following:

(a) General information and physiological response to $H_2S$ and $SO_2$ exposure.

(b) Safety procedures, equipment, training, and smoking rules.

(c) Procedures for operation conditions:

(i) Moderate danger to life.

(ii) Extreme danger to life.

(d) Responsibilities and duties of personnel for each operation condition.

(e) Designation of briefing areas as locations for assembly of personnel during Extreme Danger condition. At least two briefing areas shall be established on each drilling facility. Of these two areas, the one upwind at any given time is the safe briefing area.

(f) Evacuation plan.

(g) Agencies to be notified in case of an emergency.

(h) A list of medical personnel and facilities, including addresses and telephone numbers.

(4) *$H_2S$ Detection and Monitoring Equipment.* Each drilling facility shall have an $H_2S$ detection and monitoring system which activates audible and visible alarms before the concentration of $H_2S$ exceeds its threshold limit value of 10 parts per million in air. This equipment shall be capable of sensing a minimum of five parts per million $H_2S$ in air, with sensing points located at the bell nipple, shale shaker, mud pits, driller's stand, living quarters, and other areas where $H_2S$ might accumulate in hazardous quantities.

$H_2S$ detector ampules shall be available for use by all working personnel. After $H_2S$ has been initially detected by any device, frequent inspections of all areas of poor ventilation shall be made with a portable $H_2S$-detector instrument.

(5) *Personnel Protective Equipment.*

(a) All personnel on a drilling facility or aboard marine vessels serving the facility shall be equipped with proper personnel protective-breathing apparatus. The protective breathing apparatus used in an $H_2S$ environment shall conform to all applicable Occupational Safety and Health Administration regulations and American National Standards Institute standards. Optional equipment, such as nose cups and spectacle kits, shall be available for use as needed.

(b) The storage location of protective breathing apparatus shall be such that they are quickly and easily available to all personnel. Storage locations shall include the following:

(i) Rig floor.

(ii) A working area above the rig floor.

(iii) Mud-logging facility.

(iv) Shale-shaker area.

(v) Mud pit area.

(vi) Mud storage area.

(vii) Pump rooms (mud and cement).

(viii) Crew quarters.

(ix) Each briefing area.

(x) Heliport.

(c) A system of breathing-air manifolds, hoses, and masks shall be provided on the rig floor and in the briefing areas. A cascade air-bottle system shall be provided to refill individual protective-breathing-apparatus bottles. The cascade air-bottle system may be recharged by a high-pressure compressor suitable for providing breathing-quality air, provided the compressor suction is located in an uncontaminated atmosphere. All breathing-air bottles shall be labeled as containing breathing-quality air fit for human usage.

(d) Workboats attendant to rig operations shall be equipped with protective breathing apparatus for all workboat crew members. Pressure-demand or demand-type masks, connected to a breathing-air manifold, and additional protective breathing apparatus shall be available for evacuees. Whenever possible, boats shall be stationed upwind.

(e) Helicopters attendant to rig operations shall be equipped with a protective breathing apparatus for the pilot.

(f) The following additional personnel safety equipment shall be available for use as needed:

(i) Portable $H_2S$ detectors.

(ii) Retrieval ropes with safety harnesses to retrieve incapacitated personnel from contaminated areas.

(iii) Chalk boards and note pads located on the rig floor, in the shale-shaker area, and in the cement pump rooms for communication purposes.

(iv) Bull horns and flashing lights.

(v) Resuscitators.

(6) *Ventilation Equipment.* All ventilation devices shall be explosion-proof and situated in areas where $H_2S$ or $SO_2$ may accumulate. Movable ventilation devices shall be provided in work areas and be multidirectional and capable of dispersing $H_2S$ or $SO_2$ vapors away from working personnel.

(7) *Notification of Regulatory Agencies.* The following agencies shall be immediately notified under the alert conditions indicated:

(a) *Moderate Danger.*

(i) U. S. Geological Survey

(ii) U. S. Coast Guard

(b) *Extreme Danger.*

(i) U. S. Geological Survey.

(ii) U. S. Coast Guard

(iii) Department of Defense (when operating in Department of Defense warning areas in the northeast Gulf of Mexico).

(iv) Appropriate State agencies.

B. *Metallurgical Equipment Considerations.* Equipment used when drilling zones bearing $H_2S$ shall be constructed of materials which, according to design principles, will be able to resist damage from the phenomena known variously as sulfide stress cracking, hydrogen embrittlement, or stress corrosion cracking. Such equipment includes drill pipe, casing, casing heads, blowout-preventer stack assemblies, kill lines, choke manifolds, and other related equipment. A knowledge of the various interactions between stress, environment, and the metallurgy employed is required for successful operation in $H_2S$ environments. The following general practices are required for acceptable performance:

(1) *Drill String.* Drill strings shall be designed consistent with the anticipated depth, conditions of the hole, and reservoir environment to be encountered. Care shall be taken to minimize exposure of the drill string to high stresses as much as is practical and consistent with the anticipated hole conditions to be encountered.

(2) *Casing.* Casing, couplings, flanges, and related equipment shall be designed for $H_2S$ service. Field welding on casing (except conductor and surface strings) is prohibited unless approved by the District Supervisor.

(3) *Wellhead, Blowout Preventers, and Pressure Control Equipment.* The blowout preventer stack assembly shall be designed in accordance with criteria evolved through technology of the latest state-of-the-art for $H_2S$ service. Surface equipment such as choke lines, choke manifold, kill lines, bolting, weldments, and other related well-killing equipment shall be designed and fabricated utilizing the most advanced technology concerning sulfide stress cracking. Elastomers, packing, and similar inner parts exposed to $H_2S$ shall be resistant at the maximum anticipated temperature of exposure.

C. *Mud Program.*

(1) Either water- or oil-base muds are suitable for use in drilling formations containing $H_2S$. If oil-base muds are used, cuttings shall be cleaned of oil prior to disposal into Gulf waters.

(2) A pH of 10.0 or above shall be maintained in a water-base mud system to control corrosion and prevent sulfide stress cracking.

(3) Consideration shall also be given to the use of $H_2S$ scavengers in both water- and oil-base mud systems.

(4) Sufficient quantities of additives shall be maintained on location for addition to the mud system as needed to neutralize $H_2S$ picked up by the system when drilling in formations containing $H_2S$.

(5) The application of corrosion inhibitors to the drill pipe to afford a protective coating or their addition to the mud system may be used as an additional safeguard to the normal protection of the metal by pH control and the scavengers mentioned above.

(6) Drilling mud containing $H_2S$ gas shall be degassed at the optimum location for the particular rig configuration employed. The gases so removed shall be piped into a closed flare system and burned at a suitable remote stack.

D. *General Operations.* All personnel in the working area shall utilize $H_2S$ protective-breathing apparatus when required, as specified in paragraph 5A(2). The normal fixed-point monitor system outlined in paragraph 5A(4) may be supplemented with portable $H_2S$ detectors as conditions warrant.

(1) *Drill String Trips or Fishing Operations.* Every effort shall be made to pull a dry drill string while maintaining well control. If it is necessary to pull the drill string wet after penetration of $H_2S$-bearing zones, increased monitoring of the working area shall be provided and protective breathing apparatus shall be worn under conditions as outlined in paragraph 5A(2).

(2) *Circulating Bottoms-up from a Drilling Break, Cementing Operations, Logging Operations, or Well Circulation While Not Drilling.* After penetration of an $H_2S$-bearing zone, protective breathing apparatus shall be worn by those personnel in the working area in advance of circulating bottoms-up or when $H_2S$ is indicated by the monitoring system in quantities sufficient to require protective breathing apparatus under paragraph 5A(2), should this condition occur earlier.

(3) *Coring Operations in $H_2S$-bearing Zones.* Personnel protective-breathing apparatus shall be worn 10-20 stands in advance of retrieving the core barrel. Cores to be transported shall be sealed and marked for the presence of $H_2S$.

(4) *Abandonment or Temporary Abandonment Operations.* Internal well-abandonment equipment shall be designed for $H_2S$ service.

(5) *Logging Operations after Penetration of Known or Suspected $H_2S$-bearing Zones.* Mud in use for logging operations shall be conditioned and treated to minimize the effects of $H_2S$ on the logging equipment.

(6) *Stripping Operations.* Displaced mud returns shall be monitored and protective breathing apparatus worn if $H_2S$ is detected at levels outlined for protective breathing apparatus under paragraph 5A(2).

(7) *Gas-cut Mud or Well Kick from $H_2S$-bearing Zones.* Protective breathing apparatus shall be worn when an $H_2S$ concentration of 20 parts per million is detected. Should a decision be made to circulate out a kick, protective breathing apparatus shall be worn prior to and subsequent to bottoms-up, and at any time during an extended kill operation that the concentration of $H_2S$ becomes hazardous to personnel as defined in paragraph 5A(2)(a).

(8) *Drill String Precautions.* Precautions shall be taken to minimize drill string stresses caused by conditions such as excessive dogleg severity, improper stiffness ratios, improper torque, whip, abrasive wear on tool joints, and joint imbalance. American Petroleum Institute Bulletin RP 7G shall be used as a guideline for drill string precautions. Tool-joint compounds containing free sulphur shall not be used. Proper handling techniques shall be employed to minimize notching, stress concentrations, and possible drill pipe failures.

(9) *Flare System.* The flare system shall be designed to safely gather and burn $H_2S$ gas. Flare lines shall be located as far from the drilling facility as feasible in a manner to compensate for wind changes. The flare system shall be equipped with a pilot and an automatic igniter. Backup ignition for each flare shall be provided.

E. *Kick Detection and Well Control.* In addition to the requirements of paragraph 3B of this Order, all efforts shall be made to prevent a well kick as a result of gas-cut mud, drilling breaks, lost circulation, or trips for bit change. Drilling rate changes shall be evaluated for the possibility of encountering abnormal pressures, and mud weights adjusted in an effort to compensate for any hydrostatic imbalance that might result in a well kick.

In the event of a kick, the disposal of the well influx fluids shall be accomplished by one of the following alternatives, giving consideration to personnel safety, possible environmental damage, and possible facility well equipment damage:

*Alternative A.* To contain the well fluid influx by shutting in the well and pumping the fluids back into the formation.

*Alternative B.* To control the kick by using appropriate well-control techniques to prevent formation fracturing in open hole within the pressure limits of well equipment (drill pipe, casing, wellhead, blowout preventers, and related equipment). The disposal of $H_2S$ and other gases shall be through pressured or atmospheric mud-gas separator equipment, depending on volume and pressure of $H_2S$ gas. The equipment shall be designed to recover drilling mud and to vent to the atmosphere and burn the gases separated. The mud system shall be treated to neutralize $H_2S$ and restore and maintain the proper mud quality.

F. *Well Testing in an $H_2S$ Environment.*

(1) *Procedures.*

(a) Well testing shall be performed with a minimum number of personnel in the immediate vicinity of the rig floor and test equipment to safely and adequately perform the test and maintain related equipment and services.

(b) Prior to initiation of the test, special safety meetings shall be conducted for all personnel who will be on the drill facility during the test, with particular emphasis on the use of personnel protective-breathing apparatus, first aid procedures, and the $H_2S$ Contingency Plan.

(c) During the test, the use of $H_2S$ detection equipment shall be intensified. All produced gases shall be vented and burned through a flare system which meets the requirements of paragraph 5D(9). Gases from stored test fluids shall be vented into the flare system.

(d) "No Smoking" rules in the approved Contingency Plan of paragraph 5A(3) of this Order shall be rigorously enforced.

(2) *Equipment*.

(a) Drill-stem test tools and wellhead equipment shall be suitable for $H_2S$ service.

(b) Tubing which meets the requirements for $H_2S$ service shall be used for drill stem testing. Drill pipe shall not be used for drill stem tests without the prior approval of the District Supervisor. The water cushion shall be thoroughly inhibited in order to prevent $H_2S$ corrosion. The test string shall be flushed with treated fluid for the same purpose after completion of the test.

(c) All surface test units and related equipment shall be designed for $H_2S$ service. Only competent personnel who are trained in and knowledgeable of the hazardous effects of $H_2S$ shall be utilized in these tests.

/s/ D. W. SOLANAS
*Oil and Gas Supervisor*
*Field Operations*
*Gulf of Mexico Area*

APPROVED: NOVEMBER 25, 1974

/s/ RUSSELL G. WAYLAND
*Chief, Conservation Division*

## UNITED STATES DEPARTMENT OF THE INTERIOR
## GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

# OCS ORDER NO. 3

*Effective August 28, 1969*

## PLUGGING AND ABANDONMENT OF WELLS

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.15. The operator shall comply with the following minimum plugging and abandonment procedures which have general application to all wells drilled for oil and gas. Plugging and abandonment operations must not be commenced prior to obtaining approval from an authorized representative of the Geological Survey. Oral approvals shall be in accordance with 30 CFR 250.13. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *Permanent Abandonment.*

A. *Isolation in Uncased Hole.* In uncased portions of wells, cement plugs shall be spaced to extend 100 feet below the bottom to 100 feet above the top of any oil, gas and fresh water zones so as to isolate them in the strata in which they are found and to prevent them from escaping into other strata.

B. *Isolation of Open Hole.* Where there is open hole (uncased and open into the casing string above) below the casing, a cement plug shall be placed in the deepest casing string by (1) or (2) below, or in the event lost circulation conditions exist or are anticipated, the plug may be placed in accordance with (3) below:

(1) A cement plug placed by displacement method so as to extend a minimum of 100 feet above and 100 feet below the casing shoe.

(2) A cement retainer with effective back pressure control set not less than 50 feet nor more than 100 feet, above the casing shoe with a cement plug calculated to extend at least 100 feet below the casing shoe and 50 feet above the retainer.

(3) A permanent type bridge plug set with 150 feet above the casing shoe with 50 feet of cement on top of the bridge plug. This plug shall be tested prior to placing subsequent plugs.

C. *Plugging or Isolating Perforated Intervals.* A cement plug shall be placed opposite all open perforations (perforations not squeezed with cement) extending a minimum of 100 feet above and 100 feet below the perforated interval or down to a casing plug whichever is less. In lieu of the cement plug, a bridge plug set at a maximum of 150 feet above the open perforations with 50 feet of cement on top may be used provided the perforations are isolated from the hole below.

D. *Plugging of Casing Stubs.* If casing is cut and recovered, a cement plug 200 feet in length shall be placed to extend 100 feet above and 100 feet below the stub. A retainer may be used in setting the required plug.

E. *Plugging of Annular Space.* No annular space that extends to the Gulf floor shall be left open to drilled hole below. If this condition exists, the annulus shall be plugged with cement.

F. *Surface Plug Requirement.* A cement plug of at least 150 feet, with the top of the plug 150 feet or less below the Gulf floor, shall be placed in the smallest string of casing which extends to the surface.

G. *Testing of Plugs.* The setting and location of the first plug below the top 150-foot plug, will be verified by either (1) placing a minimum pipe weight of 15,000 pounds on the plug, or (2) testing with a minimum pump pressure of 1,000 psig with no more than a 10 percent pressure drop during a 15-minute period.

H. *Mud.* Each of the respective intervals of the hole between the various plugs shall be filled with mud fluid of sufficient density to exert hydrostatic pressure exceeding the greatest formation pressure encountered while drilling such interval.

# OCS ORDER NO. 3

1. *Clearance of Location.* All casing and piling shall be severed and removed to at least 15 feet below the Gulf floor and the location shall be dragged to clear the well site of any obstructions.

2. *Temporary Abandonment.* Any drilling well which is to be temporarily abandoned shall be mudded and cemented as required for permanent abandonment except for requirements F and I of paragraph 1 above. When casing extends above the Gulf floor, a mechanical bridge plug (retrievable or permanent) shall be set in the casing between 15 and 200 feet below the Gulf floor.

/s/ ROBERT F. EVANS
*Supervisor*

APPROVED: AUGUST 28, 1969

/s/ RUSSELL G. WAYLAND
*Chief, Conservation Division*

## UNITED STATES DEPARTMENT OF THE INTERIOR
## GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

# OCS ORDER NO. 4

*Effective August 28, 1969*

## SUSPENSIONS AND DETERMINATION OF WELL PRODUCIBILITY

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.12(d)(1). An OCS lease provides for extension beyond its primary term for as long as oil or gas may be produced from the lease in paying quantities. An OCS lease may be maintained beyond the primary term, in the absence of actual production, when a suspension of operations or production, or both, has been approved. An application for suspension of production for an initial period should be submitted prior to the expiration of the term of a lease. The supervisor may approve a suspension of production provided at least one well has been drilled on the lease and determined to be capable of being produced in paying quantities. The temporary or permanent abandonment of a well will not preclude approval of a suspension of production as provided in 30 CFR 250.12(d)(1). Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

A well may be determined to be capable of producing in paying quantities when the requirements of either 1 or 2 below have been met.

1. *Production Tests.*

A. *Oil Wells.* A production test of at least two hours duration, following stabilization, is required.

B. *Gas Wells.* A deliverability test of at least two hours duration, following stabilization, or a four-point back-pressure test, is required.

C. *Witnessing and Results.* All tests must be witnessed by an authorized representative of the Geological Survey. Test data accompanied by operator's affidavit, or third-party test data, may be accepted in lieu of a witnessed test provided prior approval is obtained from the appropriate district office. The results of the witnessed or accepted test must justify a determination that the well is capable of producing in paying quantities.

2. *Production Capability.* Information for determining producibility should be submitted in time to permit one week for evaluation and determination. In cases of urgency, determinations may be conveyed orally. The following may be considered as acceptable evidence that a well is capable of producing in paying quantities:

A. An induction-electric log of the well, clearly showing a minimum of 15 feet of producible sand in one section which does not include any interval which appears to be water saturated. All of the section counted as producible must exhibit the following properties:

(1) Electrical spontaneous potential exceeding 20 negative millivolts beyond the shale base line. If mud conditions prevent a 20 negative millivolt reading beyond the shale base line, a gamma ray log deflection of at least 70 percent of the maximum gamma ray deflection in the nearest clean water bearing sand may be substituted.

(2) A minimum true resistivity ratio of the producible section to the nearest clean water sand of at least 5:1, provided the producible section exhibits a minimum resistivity of 2.0 ohm-meters.

(3) A porosity log indicating porosity in the producible section.

B. Sidewall cores and core analysis which indicates that the section is producible.

C. A wire line formation test or evidence that an attempt was made to obtain such test. The test results must indicate that the section is producible.

D. All logs run must support other evidence that the section is producible.

/s/ Robert F. Evans
*Supervisor*

Approved: August 28, 1969

/s/ Russell G. Wayland
*Chief, Conservation Division*

## UNITED STATES DEPARTMENT OF THE INTERIOR
## GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

# OCS ORDER NO. 5

*Effective June 5, 1972*

### SUBSURFACE SAFETY DEVICES

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.41(b). Section 250.41(b) provides as follows:

> (b) Completed Wells. In the conduct of all its operations, the lessee shall take all steps necessary to prevent blowouts, and the lessee shall immediately take whatever action is required to bring under control any well over which control has been lost. The lessee shall: (1) in wells capable of flowing oil or gas, when required by the supervisor, install and maintain in operating condition storm chokes or similar subsurface safety devices; (2) for producing wells not capable of flowing oil or gas, install and maintain surface safety valves with automatic shutdown controls; and (3) periodically test or inspect such devices or equipment as prescribed by the supervisor.

The operator shall comply with the following requirements. All departures from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 250.12(b). All applications for approval under the provisions of this Order shall be submitted to the appropriate District office. References in this Order to approvals, determinations, or requirements are to those given or made by the Supervisor or his delegated representative.

1. *Installation.* All new and existing tubing installations open to hydrocarbon-bearing zones shall be equipped with a subsurface-controlled or a surface- or other remotely controlled subsurface safety device, to be installed at a depth of 100 feet or more below the sea floor unless, after application and justification, the well is determined to be incapable of flowing oil or gas. These installations shall be made as required in subparagraphs A and B below within two (2) days after stabilized production is established, and during this period of time the well shall not be left unattended while open to production.

A. *New Wells.* All tubing installations in wells completed after December 1, 1972, shall be equipped with a surface- or other remotely controlled subsurface safety device; provided, that wells with a shut-in tubing pressure of 4,000 psig or greater shall be equipped with a subsurface-controlled subsurface safety device in lieu of a surface- or other remotely controlled subsurface safety device unless a surface- or other remotely controlled subsurface safety device is approved or required. When the shut-in tubing pressure declines below 4,000 psig, a surface- or other remotely controlled subsurface safety device shall be installed when the tubing is first removed and reinstalled.

B. *Existing Wells.* All tubing installations in wells existing on the date of this Order shall be equipped with a surface- or other remotely controlled subsurface safety device when the tubing is first removed and reinstalled after December 1, 1972; provided, that wells with a shut-in tubing pressure of 4,000 psig or greater shall be equipped with a subsurface-controlled subsurface safety device in lieu of a surface- or other remotely controlled subsurface safety device unless a surface- or other remotely controlled subsurface safety device is approved or required. When the shut-in tubing pressure declines below 4,000 psig, a surface- or other remotely controlled subsurface safety device shall be installed when the tubing is first removed and reinstalled.

Tubing installations in existing wells completed from single-well and multi-well satellite caissons or jackets and sea-floor completions may be equipped with a subsurface-controlled subsurface safety device, in lieu of a surface- or other remotely controlled subsurface safety device, upon application, justification, and approval.

C. *Shut-in Wells.* A tubing plug shall be installed in lieu of, or in addition to, other subsurface safety devices if a well has been shut in for a period of six (6) months. Such plugs shall be set at a depth of 100 feet or more below the sea floor. All retrievable plugs installed after the date of this Order shall be of the pump-through type. All wells perforated and completed, but not placed on production, shall be equipped with a subsurface safety device or tubing plug within two (2) days after completion.

D. *Injection Wells*. Subsurface safety devices as required in subparagraphs A and B above shall be installed in all injection wells unless, after application and justification, it is determined that the well is incapable of flowing oil or gas, which condition shall be verified annually.

2. *Technological Advancement*. As technological research, progress, and product improvement result in increased effectiveness of existing safety devices or the development of new devices or systems, such devices or systems may be required or used upon application, justification, and approval. Applications for routine use shall include evidence that the device or system has been field-tested at least once each month for a minimum of six (6) consecutive months, and that each test indicated proper operation.

3. *Testing and Inspection*. Subsurface safety devices shall be designed, adjusted, installed, and maintained to insure reliable operation. During testing and inspection procedures, the well shall not be left unattended while open to production unless a properly operating subsurface safety device has been installed in the well.

A. *Surface-Controlled Subsurface Safety Devices*. Each surface- or other remotely controlled subsurface safety device installed in a well shall be tested in place for proper operation when installed and thereafter at intervals not exceeding six (6) months. If the device does not operate properly, it shall be removed, repaired, and reinstalled or replaced and tested to insure proper operation.

B. *Subsurface-Controlled Subsurface Safety Devices*. Each subsurface-controlled subsurface safety device installed in a well shall be removed, inspected, and repaired or adjusted as necessary and reinstalled at intervals not exceeding six (6) months; provided, that such removable devices set in a landing nipple shall be removed, inspected, and repaired or adjusted as necessary and reinstalled at intervals not exceeding twelve (12) months. Each velocity-type device shall be designed to close at a flow rate not to exceed the larger of either 150 percent of, or 200 BFPD above, the most recent well-test rate which equals or exceeds the approved production rate. The above closing flow rate shall not exceed the calculated capacity of the well to produce against a flowing wellhead pressure of 50 psig. Each preset tubing-pressure-actuated device shall be designed to close prior to reduction of the flowing wellhead pressure to 50 psig.

C. *Tubing Plugs*. A shut-in well equipped with a tubing plug shall be inspected for leakage by opening the well to possible flow at intervals not exceeding six (6) months. If sustained liquid flow exceeds 400 cc/min., or gas flow exceeds 15 cu. ft./min., the plug shall be removed, repaired, and reinstalled or an additional tubing plug installed to prevent leakage.

4. *Temporary Removal*. Each wireline- or pumpdown-retrievable subsurface safety device may be removed, without further authority or notice, for a routine operation which does not require approval of a Sundry Notice and Report on Wells (Form 9-331) for a period not to exceed fifteen (15) days. The well shall be clearly identified as being without a subsurface safety device and shall not be left unattended while open to production. The provisions of this paragraph are not applicable to the testing and inspection procedures in paragraph 3 above.

5. *Additional Protective Equipment*. All tubing installations made after the date of this Order in which a wireline- or pumpdown-retrievable subsurface safety device is to be installed shall be equipped with a landing nipple, with flow couplings or other protective equipment above and below, to provide for setting of the subsurface safety device. All wells in which a subsurface safety device or tubing plug is installed shall have the tubing-casing annulus packed off above the uppermost open casing perforation. The control system for all surface-controlled subsurface safety devices shall be an integral part of the platform shut-in system, or of an independent remote shut-in system.

6. *Departures*. All departures (or waivers) approved prior to the date of this Order are hereby terminated as of December 1, 1972, unless new applications are submitted prior to that date. All such new applications will be considered for approval pursuant to 30 CFR 250.12(b) and the requirements of this Order. All applications for departures shall include a detailed statement of the well conditions, efforts made to overcome any difficulties, and proposed alternate safety measures.

7. *Emergency Action*. All tubing installations open to hydrocarbon-bearing zones and not equipped with a subsurface safety device as permitted by this Order shall be clearly identified as not being so equipped, and a subsurface safety device or tubing plug shall be available at the field location. In the event of an emergen-

cy, such as an impending hurricane, such device or plug shall be promptly installed within the limits of practicability, due consideration being given to personnel safety.

8. *Records.* The operator shall maintain the following records for a minimum period of one year for each subsurface safety device and tubing plug installed, which records shall be available to any authorized representative of the Geological Survey.

A. *Field Records.* Individual well records shall be maintained at or near the field and shall include, as a minimum, the following information:

(1) A record which will give design and other information; i.e., make, model, type, spacers, bean and spring size, pressure, etc.

(2) Verification of assembly by a qualified person in charge of installing the device and installation date.

(3) Verification of setting depth and all operational tests as required in this Order.

(4) Removal date, reason for removal, and reinstallation date.

(5) A record of all modifications of design in the field.

(6) All mechanical failures or malfunctions, including sandcutting, of such devices, with notation as to cause or probable cause.

(7) Verification that a failure report was submitted.

B. *Other Records.* The following records, as a minimum, shall be maintained at the operator's office:

(1) Verified design information of subsurface-controlled subsurface safety devices for the individual well.

(2) Verification of assembly and installation according to design information.

(3) All failure reports.

(4) All laboratory analysis reports of failed or damaged parts.

(5) Quarterly failure-analysis report.

9. *Reports.* Well completion report (Form 9-330) and any subsequent reports of workover (Form 9-331) shall include the type and the depth of the subsurface safety devices and tubing plugs installed in the well or indicate that a departure has been granted.

To establish a failure-reporting and corrective-action program as a basis for reliability and quality control, each operator shall submit a quarterly failure-analysis report to the office of the Supervisor, identifying mechanical failure by lease and well, make and model, cause or probable cause of failure, and action taken to correct the failure. The reporting period shall begin the first day of the month following the date of this Order. The reports shall be submitted by February 28, May 31, August 31, and November 30 for the periods ending January 31, April 30, July 31, and October 31 of each year.

/s/ ROBERT F. EVANS
*Supervisor*

APPROVED: JUNE 5, 1972

/s/ RUSSELL G. WAYLAND
*Chief, Conservation Division*

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

# OCS ORDER NO. 6

*Effective August 28, 1969*

## COMPLETION OF OIL AND GAS WELLS

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.92. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *Wellhead Equipment and Testing Procedures.*

A. *Wellhead Equipment.* All completed wells shall be equipped with casingheads, wellhead fittings, valves and connections with a rated working pressure equal to or greater than the surface shut-in pressure of the well. Connections and valves shall be designed and installed to permit fluid to be pumped between any two strings of casing. Two master valves shall be installed on the tubing in wells with a surface pressure in excess of five thousand pounds per square inch. All wellhead connections shall be assembled and tested, prior to installation, by a fluid pressure which shall be equal to the rated test pressure of the fitting to be installed.

B. *Testing Procedure.* Any wells showing sustained pressure on the casinghead, or leaking gas or oil between the production casing and the next larger casing string, shall be tested in the following manner: The well shall be killed with water or mud and pump pressure applied. Should the pressure at the casinghead reflect the applied pressure, the casing shall be condemned. After corrective measures have been taken, the casing shall be tested in the same manner. This testing procedure shall be used when the origin of the pressure cannot be determined otherwise.

2. *Storm Choke.* All completed wells shall meet the requirements prescribed in OCS Order No. 5.

3. *Procedures for Multiple or Tubingless Completions.*

A. *Multiple Completions.*

(1) Information shall be submitted on, or attached to, Form 9-331 showing top and bottom of all zones proposed for completion or alternate completion, including a partial electric log and a diagrammatic sketch showing such zones and equipment to be used.

(2) When zones approved for multiple completion become inter-communicated the lessee shall immediately repair and separate the zones after approval is obtained.

B. *Tubingless Completions*

(1) All tubing strings in a multiple completed well shall be run to the same depth below the deepest producible zone.

(2) The tubing string(s) shall be new pipe and cemented with a sufficient volume to extend a minimum of 500 feet above the uppermost producible zone.

(3) A temperature or cement bond log shall be run in all tubingless completion wells where lost circulation or other unusual circumstances occur during the cementing operations.

(4) Information shall be submitted on, or attached to, Form 9-331 showing the top and bottom of all zones proposed for completion or alternate completion, including a partial electric log and a diagrammatic sketch showing such zones and equipment to be used.

/s/ Robert F. Evans
*Supervisor*

Approved: August 28, 1969

/s/ Russell G. Wayland
*Chief, Conservation Division*

## UNITED STATES DEPARTMENT OF THE INTERIOR
## GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

# REVISION OF OCS ORDER NO. 7

### POLLUTION AND WASTE DISPOSAL

By Notice in the FEDERAL REGISTER dated December 3, 1974, (39 FR 41877) comments were solicited on a proposed revision of OCS Order No. 7, Pollution and Waste Disposal, for the Gulf of Mexico Area. As a result of these comments and additional input from field office personnel of the Geological Survey, a modified revision of this Order is now proposed and included herein.

The proposed revision reflects developments in pollution control and is cross referenced with a revision of OCS Order No. 8, Platforms, Structures, and Associated Equipment. Waste disposal standards which were formerly included in OCS Order No. 8 are now appropriately included in OCS Order No. 7. Interested persons may submit written comments and suggestions to the Director, U.S. Geological Survey, National Center, 12201 Sunrise Valley Drive, Reston, Virginia 22092, on or before January 5, 1976. Comments will be considered and included in the final version of the Order as appropriate.

/s/ W. A. Radlinski
*Acting Director*

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

# OCS ORDER NO. 7

*Effective*

## POLLUTION AND WASTE DISPOSAL

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.43. The operator shall comply with the following requirements. All departures from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 250.12(b).

1. *Pollution Prevention.* In the conduct of all oil and gas operations, the operator shall prevent pollution of the Gulf. Furthermore, the disposal of waste materials into the Gulf shall not create conditions which will adversely affect the public health, life or property, aquatic life or wildlife, recreation, navigation, or other uses of the Gulf.

A. *Liquid Disposal.*

(1) Drilling mud containing oil shall not be disposed of into the Gulf.

(2) The operator shall submit with the Application for Permit to Drill (Form 9-331C) a detailed list of drilling mud constituents and their concentrations, including the chemical composition of trade name components, and a list of the drilling mud additives which might be used to meet special drilling requirements. Drilling mud containing toxic substances shall be neutralized prior to disposal.

(3) Curbs, gutters, and drains on platforms and structures shall be installed and maintained in accordance with the provisions of OCS Order No. 8.

(4) Produced waste water disposal systems shall be designed and maintained so that the oil content of the effluent shall meet applicable requirements promulgated by the Environmental Protection Agency pursuant to the Federal Water Pollution Control Act as amended.

(a) A copy of the results of all analyses submitted to the Environmental Protection Agency shall be similarly submitted to the Area Supervisor, and a copy of the most recent analysis shall be maintained at the discharge site or field production headquarters and be available for inspection by Geological Survey personnel.

(b) Should an analysis indicate that the effluent does not meet the above requirements, corrective action shall be taken immediately. Approval to continue operations to aid in the identification and remedy of the problem shall be obtained from the Area Supervisor. Such approval shall be contingent upon submittal of a follow-up report to the Area Supervisor within 10 days.

(5) The disposal of produced waste water other than into the Gulf shall have the method and location approved by the Area Supervisor.

B. *Solid Waste Disposal.*

(1) Drill cuttings, sand, and other solids containing oil shall not be disposed of into the Gulf unless all of the free oil has been removed.

(2) Mud containers and other solid waste materials shall be incinerated or transported to shore for disposal in accordance with Federal, State, or local requirements.

(3) All sewage shall be treated so that effluent shall meet applicable requirements promulgated by the Environmental Protection Agency pursuant to the Federal Water Pollution Control Act as amended.

(a) A copy of the results of all analyses submitted to the Environmental Protection Agency shall be similarly submitted to the Area Supervisor, and a copy of the most recent analysis shall be maintained at the discharge site or field production headquarters and be available for inspection by Geological Survey personnel.

(b) Should an analysis indicate that the effluent does not meet the above requirements, corrective action shall be taken immediately. Approval to continue operations to aid in the identification and remedy of the problem shall be obtained from the Area Supervisor. Such approval shall be contingent upon submittal of a follow-up report to the Area Supervisor within 10 days.

2. *Personnel, Inspections, and Reports.*

A. *Personnel.* The operator's personnel shall be thoroughly instructed in the techniques of equipment maintenance and operation for the prevention of pollution. Nonoperator personnel shall be informed in writing, prior to executing contracts, of the operator's obligations to prevent pollution.

B. *Pollution Inspections.*

(1) Manned facilities shall be inspected daily.

(2) Unattended facilities, including those equipped with remote control and monitoring systems, shall be inspected at frequent intervals. The district supervisor may prescribe the frequency of inspections for these facilities.

(3) All production facilities, such as separators, tanks, treaters, and other equipment shall be such as are necessary to control the maximum anticipated pressures and production of oil and gas. Maintenance or repairs as are necessary to prevent pollution of the Gulf shall be undertaken immediately.

C. *Pollution Reports.* All pollution reports required shall be submitted on Form 9-1880, entitled, Pollution Report.

(1) All spills of oil and liquid pollutants shall be recorded showing the cause, size of spill, and action taken, and the record shall be maintained and available for inspection by the District Supervisor. All spills of less than 2.4 cubic metres (15 barrels) shall be reported orally to the District Supervisor within 12 hours and shall be confirmed in writing.

(2) All spills of oil and liquid pollutants of 2.4 to 7.9 cubic metres (15 to 50 barrels) shall be reported orally to the District Supervisor immediately and shall be confirmed in writing.

(3) All spills of oil and liquid pollutants of a substantial size or quantity, which is defined as more than 7.9 cubic metres (50 barrels), and those of any size or quantity which cannot be immediately controlled, shall be reported orally without delay to the District Supervisor, the Coast Guard, and the Regional Administrator, Environmental Protection Agency. All oral reports shall be confirmed in writing.

(4) Operators shall notify each other upon observation of equipment malfunction or pollution resulting from another's operation.

3. *Pollution Control Equipment and Oil Spill Contingency Plan.*

A. *Equipment.*

Standby pollution control equipment and materials shall be maintained by, or shall be available to, each operator at an offshore or onshore location. This shall include containment booms, skimming apparatus, clean-up materials and chemical agents, and shall be available prior to the commencement of operations. No chemicals shall be used without prior approval of the Area Supervisor. The equipment and materials shall be inspected monthly and maintained in good condition for use. The results of the inspections shall be recorded and maintained at the site.

B. *Oil Spill Contingency Plan.* The operator shall submit an oil spill contingency plan for approval by the Area Supervisor before consideration can be given to approval of an application for permit to conduct operations. This plan shall contain the following:

(1) Provisions to assure that full resource capability is known and can be committed during an oil discharge situation including the identification and inventory of applicable equipment, materials, and supplies which are available locally and regionally, both committed and uncommitted, and the time required for deployment.

(2) Provisions for varying degrees of response effort depending on the severity of the oil discharge.

(3) Establishment of notification procedures for the purpose of early detection and timely notification of an oil discharge including a current list of names, telephone numbers, and addresses of the responsible persons and alternates on call to receive notification of an oil discharge, as well as the names, telephone numbers, and addresses of regulatory organizations and agencies to be notified when an oil discharge is discovered.

(4) Provisions for well defined and specific actions to be taken after discovery and notification of an oil discharge including:

(a) Specification of an oil discharge response operating team consisting of trained, prepared and available operating personnel.

(b) Predesignation of an oil discharge response coordinator who is charged with the responsibility and delegated commensurate authority for directing and coordinating response operations.

(c) A preplanned location for an oil discharge response operations center and a reliable communications system for directing the coordinated overall response operations.

4. *Spill Control and Removal.* Immediate corrective action shall be taken in all cases where pollution has occurred. Corrective action taken under the Oil Spill Contingency Plan shall be subject to modification when directed by the Area Supervisor. The primary jurisdiction to require corrective action to abate the source of pollution and to enforce the subsequent clean-up by the lessee or operator shall remain with the Area Supervisor pursuant to the provisions of the Order and the memorandum of understanding between the Department of Transportation (U.S. Coast Guard) and the Department of the Interior (U.S. Geological Survey) dated August 16, 1971.

5. *Annual Contingency Plan.* Annual contingency plan assessments will be conducted in conjunction with Plan of Development review. Upon request of the Area Supervisor, revised contingency plans reflecting changes in personnel, equipment, and methods shall be submitted.

/s/ D. W. SOLANAS
*Area Oil and Gas Supervisor*

APPROVED:

/s/ RUSSELL G. WAYLAND
*Chief, Conservation Division*

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# UNITED STATES DEPARTMENT OF THE INTERIOR
# GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

## REVISION OF OCS ORDER NO. 8

### PLATFORMS, STRUCTURES, AND ASSOCIATED EQUIPMENT

A proposed revision to OCS Order No. 8, "Platforms, Structures, and Associated Equipment," was published in the FEDERAL REGISTER on June 3, 1974, with a solicitation for comments. In addition, a further revision of the Order was published on January 21, 1975, and a public meeting held on February 25, 1975, to discuss the technical aspects of the proposed revisions. All comments received from these solicitations have been considered and included in the proposed Order as appropriate.

Inasmuch as the latest proposed revision of Order No. 8 has been modified to some extent from the earlier versions, it is believed that an additional comment period should be offered. In particular, the Geological Survey is interested in receiving comments on the use of the Recommended Practice developed by a committee of the American Petroleum Practice for Analysis, Design, Installation, and Testing of Basic Surface Safety Systems on Offshore Production Platforms. This document has been reviewed by a subpanel of the Marine Board of the Assembly of Engineering of the National Research Council which recommended its use. The Geological Survey has found the document to be applicable to the design of production facilities on offshore platforms with certain modifications. The necessary modifications are included in OCS Order No. 8.

Interested persons may submit written comments and suggestions to the Director, U.S. Geological Survey, National Center, 12201 Sunrise Valley Drive, Reston, Virginia 22092, by January 5, 1976.

/s/ W. A. Radlinski
*Acting Director0*

## UNITED STATES DEPARTMENT OF THE INTERIOR
## GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

# OCS ORDER NO. 8

*Effective*

## PLATFORMS, STRUCTURES, AND ASSOCIATED EQUIPMENT

This order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.19(a). Section 250.19(a) provides as follows:

> (a) The supervisor is authorized to approve the design, other features, and plan of installation of all platforms, fixed structures, and artificial islands as a condition of the granting of a right of use or easement under Paragraphs (a) and (b) of Section 250.18 or authorized under any lease issued or maintained under the Act.

The operator shall be responsible for compliance with the requirements of this Order in the installation and operation of all platforms and structures, including all facilities installed on a platform or structure, whether or not operated or owned by the operator. All departures from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 250.12(b). All applications for approval under the provisions of this Order shall be submitted to the appropriate District Supervisor. References in this Order to approvals, determinations, or requirements are to those given or made by the Area Oil and Gas Supervisor or his delegated representative.

Following approval of applications, installations and operations shall be performed as approved. If deemed advisable, changes to approved applications may be proposed; however, approval of such proposal shall be required prior to implementation.

The following requirements are applicable to all platforms and structures approved and installed subsequent to the effective date of the Order. When structural or equipment modifications to existing platforms and structures are proposed, only requirements relevant to the modifications shall be applicable.

1. *Platform Design.*

A. *General Design.* A platform or structure shall be designed for safe installation and operation for its intended use and service life at a specific site. Steel structures shall be designed in accordance with those provisions of API RP 2A, "Planning, Designing and Constructing Fixed Offshore Platforms," January 1975. The design of structures other than steel shall be evaluated on an individual basis. Consideration shall be given to conditions which may contribute to structural damage such as:

(1) Wind, wave, and current forces and other environmental loading forces.

(2) Functional loading conditions including the weight of the structure and all permanently fixed equipment and the effects of static and dynamic functional load conditions during installation and the design operational service period.

(3) Water depth, bottom topography, surface and subsurface soil conditions, slope stability, scour conditions, and other pertinent geologic conditions based on information from on-site investigations.

2. *Application.* Prior to installation of a fixed platform or structure, the operator shall submit for approval, in duplicate, an application showing essential features of the platform or structure and supporting design information as follows:

A. *General Information.*

(1) Identification data, which shall include the platform or structure designation, lease number, area name, block number, and operator.

(2) Location data, including plat showing the distance from the nearest two block lines.

(3) Primary use and other intended functions, including planned drilling, production, and storage operations.

(4) Personnel facilities, personnel access to living quarters, boat landings, and heliports.

(5) A description of each planned phase of operation, including simultaneous operations for the service life of the platform or structure.

(6) Drawings and plats to clearly illustrate essential parts, including number and location of well slots, water depth, nominal size and thickness of jacket and deck column legs, nominal size, thickness, and design penetration of piling.

(7) A description of the method of corrosion protection.

B. *Environmental Information.*

(1) List of pertinent environmental data which have a bearing on the installation, operation, or design of the platform or structure, including wave height, current, wind velocity, water depth, storm and astronomical tide data, and factors considered in subparagraph 1.A.(3).

(2) Listing of total design functional loads and wind, wave, and current forces for the following approaches: longitudinal, transverser, and diagonal.

C. *Foundation.*

(1) A listing on on-site investigations and tests, including the results.

(2) A description of foundation loads for environmental and functional forces listed in subparagraphs 2.B(1) and (2).

(3) In areas susceptible to soil movement, an analysis of slope and soil stability in relation to the foundation design loads.

D. *Installation.* Procedures for installation of the platform or structure shall be submitted. The recommendations contained in API RP 2A, "Planning, Designing, and Constructing Fixed Offshore Platforms," January 1975, are acceptable.

E. *Exception to Supporting Design Information Submittal.* The following information shall be developed and utilized in platform design: However, submittal with the construction application is not required. This information shall be made available to the appropriate District Supervisor upon his request.

(1) A description of the critical design loading and design criteria, taking into consideration maximum environmental and operational loading conditions expected over the service life of the platform or structure. This shall include those conditions considered under subparagraphs l.A (1), (2), and (3) above.

(2) For steel structures, a description of the materials, specifications, strength analyses, and allowable stresses over the service life.

The recommendations of API publications API RP 2A, "Planning, Designing, and Constructing Fixed Offshore Platforms," January 1975, are acceptable practice concerning subparagraphs (1) and (2) above.

(3) For concrete structures, a description of the materials, specification, and strength and serviceability requirements and analyses of the reinforcing systems.

3. *Certification.*

A. Detailed structural plans certified by a registered professional engineer shall be on file and maintained by the operator or his designee.

B. The following certifications, signed and dated by a company representative, shall accompany the application:

(1) "(Operator) certifies that this platform has been certified by a registered professional engineer and the structure will be constructed, operated, and maintained as described in the application and any approved modification thereto. Certified Plans are on file at.............."

(2) Certification that the mechanical and electrical systems of the facility will be designed and installed under the supervision of a registered professional engineer. Maintenance of these systems will be by qualified personnel.

4. *Design, Installation, and Operational Features of Production Facilities.*

A. All production facilities, including separators, treaters, compressors, headers, and pipelines, shall be designed, installed, and maintained in a manner which will facilitate efficient, safe, and pollution-free operation.

B. As soon as practicable, but not later than three months after the effective date of this Order, new platform production facilities shall be protected with a basic and ancillary surface safety system designed, analyzed, installed, tested, and maintained in operating conditions in accordance with the provisions of API RP 14C "Analysis, Design, Installation, and Testing of Basic Surface Safety Systems on Offshore Production Platforms," June 1974, as amended November 1975, and the additional requirements of this Order. For this application, the words "should" contained in API RP 14C shall be read "shall" except for those contained in explanatory statements, paragraphs 3.4(c), page 11 and 4.3(4)(a)-(f), pages 19-20. In the event that processing components are to be utilized other than those for which Safety Analysis Tables (SAT's) and Safety Analysis Checklists (SAC's) are included in API RP 14C, the analysis technique and documentation specified therein shall be utilized to determine the effects and requirements of such components upon the safety system.

Operators may utilize the options contained in API RP 14C during Safety Systems Design; however, options selected and depicted on the schematic flow diagrams and Safety Analysis Function Evaluation (SAFE) Chart are subject to approval by the appropriate District Supervisor.

C. Prior to installation, the operator shall submit for approval, in duplicate, information relative to design and installation features, as indicated in subparagraphs (1) through (6) below. This information shall also be maintained at the operator's onshore field engineering office.

(1) A flow schematic showing size, capacity, and design working pressure of separators, treaters, storage tanks, compressors, pipeline pumps, and metering devices.

(2) A schematic flow diagram (Reference API RP 14C, Example Figure E1, page 79) and the related Safety Analysis Function Evaluation (SAFE) Chart (Reference API RP 14C, paragraph 4.3(C), page 20). These shall be developed with consideration of the revisions of API RP 14C and the additional requirements of this Order.

(3) A schematic piping diagram showing the size and design working pressure with reference to welding specification(s) or code(s) used.

(4) A diagram of the fire-fighting system.

(5) Electrical system information including the following:

(a) Plan view of each platform deck outlining any nonhazardous area; i.e., areas which are unclassified with respect to electrical equipment installations, and areas in which potential ignition sources, other than electrical, are to be installed. The area outline should include the following information:

(i) Any surrounding production or other hydrocarbon source and a description of deck, overhead, and firewall.

(ii) Location of generators, control rooms, panel boards, major cabling-conduit routes and identification of wiring method.

(b) Elementary electrical schematic of any platform safety-shutdown system with functional legend.

(6) An application for the installation and maintenance of all gas detection systems. The application shall include the following:

(a) Type, location, and number of detection heads.

(b) Type and kind of alarm, including emergency equipment to be activated.

(c) Method used for detection of combustible gases.

(d) Method and frequency of calibration.

(e) Name and qualifications of organization or personnel to perform system inspection and calibration.

(f) A functional block diagram of the gas detection system, including the electric power supply.

(g) Other pertinent information.

D. *Additional Safety and Pollution Control Requirements*. The following requirements modify, or are in addition to, those contained in API RP 14C. For platforms installed after the effective date of this Order compliance is required as soon as practicable, but not later than three months after the effective date. Operators of platforms and structures installed prior to the effective date of this Order shall comply with three requirements at the earliest practicable date, but not later than one year from the effective date, unless otherwise specified herein.

(1) *Design and Installation.*

(a) Pressure Vessels.

(i) In addition to the protection specified in API RP 14C, Section A.4.2.b(1)(a), (b) (part), and (c), page 34, hydrocarbon-handling pressure vessels other than separators and pressure or surge tanks shall be equipped with high- and low-liquid level shut-in controls.

(ii) Pressure relief valves shall be designed, installed, and maintained in accordance with applicable provisions of Sections I, IV, and VIII of the ASME Boiler and Pressure Vessel Code, July 1, 1974. All relief valves and vents shall be piped in such a way as to minimize the possibility of fluid striking personnel or ignition sources.

(iii) Steam generators shall be equipped with low-water-level controls in accordance with applicable provisions of Sections I and IV of the ASME Boiler and Pressure Vessel Code, July 1, 1974.

(iv) All relief valves shall be set to start relieving at the design working pressure of the vessel and shall be sized to prevent the pressure from rising more than 10 percent above the design working pressure of the vessel or as otherwise provided by Section VIII of the ASME Boiler and Pressure Vessel Code, July 1, 1974. The high-pressure shut-in sensor shall activate sufficiently below the design working pressure to positively insure operation before the relief valve starts relieving. The low-pressure shut-in sensor shall activate no lower than 15 percent or 5 psi, whichever is greater, below the lowest pressure in the operating range.

(v) Pressure sensors may be of the automatic or nonautomatic reset type, but where the automatic reset types are used, a non-automatic reset relay shall be installed. All pressure sensors shall be equipped to permit testing with an external pressure source.

(vi) All pressure or fired vessels used in the production of oil or gas, installed after the effective date of this Order, shall conform to the requirements stipulated in the edition of the ASME Boiler and Pressure Vessel Code, Sections I, IV, and VIII, as appropriate, in effect at the time the vessel is installed. Uncoded vessels now in use shall have been hydrostatically tested to a pressure 1.5 times their normal working pressure. The test date, test pressure, and working pressure shall, within six months after the effective date of this Order, be marked on the vessel in a prominent place. A record of the test shall be maintained by the operator.

(b) *Flowlines.*

(i) All flowlines from wells shall be equipped with high- and low-pressure shut-in sensors located downstream of the well choke. If there is more than 10 feet of line between the wellhead wing valve and the primary choke, an additional low-pressure shut-in sensor shall be installed in this section. The high-pressure shut-in sensor shall be set no higher than 10 percent above the highest operating pressure of the line, but in all cases, it shall be set sufficiently below the maximum shut-in pressure of the well or the gas-lift supply pressure to assure actuation of the surface safety valve. The low-pressure shut-in sensor shall be set no lower than 10 percent or 5 psi, whichever is greater, below the lowest operating pressure of the line in which it is installed.

(ii) In the event a well flows directly to the pipeline before separation, the flowline and valves from the well located upstream of, and including the header inlet valve(s), shall be able to withstand the maximum shut-in pressure of the well, unless 1: protected by a relief valve connected to either the platform flare scrubber or some other approved location other than into the departing pipeline, or 2: the flowline is equipped with an additional automatic shutdown valve controlled by an independent high-pressure sensor. The platform flare scrubber shall be designed to handle, without liquid hydrocarbon carryover to flare, the maximum anticipated flow of liquid hydrocarbons which may be relieved to the vessel.

(c) *Remote Shut-In Systems.*

(i) Remote shut-in controls shall be quick-opening valves, except those on the boat landing(s), which may be a plastic loop.

(d) *Engine Exhausts.*

(i) All engine exhausts with temperatures greater than 400°F. (205°C.) shall be insulated and piped away from fuel sources. Exhaust piping from diesel engines shall be equipped with spark arrestors.

(e) *Glycol Dehydration Units.*

(i) A hydrocarbon separator shall be installed in the glycol return line on all glycol dehydration units.

(f) *Compressors.*

(i) Each compressor installation existing as of the effective date of this Order shall be protected by high-liquid-level shut-in controls and a pressure relief valve installed on each interstage scrubber. High-temperature shutdown controls shall be installed on the compressor cylinders unless interstage scrubbers are protected by high- and low-pressure shut-in controls.

All compressor installations initiated as of the effective date of this Order shall be protected by high- and low-pressure and high-liquid-level shut-in controls and a pressure relief valve installed on each interstage scrubber.

All compressor interstage scrubbers shall be protected by low-liquid-level shut-in controls unless dump is through a choke restriction to another pressure vessel.

(ii) In addition to the provisions of API RP 14C, paragraphs A8.3a and A8.3d, high- and low-pressure shut-in sensors and low-liquid-level shut-in controls protecting compressors suction and discharge piping and associated suction and interstage scrubbers shall be designed to actuate automatic isolation valves located in each compressor suction and fuel gas line so that the compressor unit and associated vessels can be isolated from all input sources.

For compressors installed after the effective date of this Order, those compressor units installed in a building shall have the isolation valves located outside the building. Each suction and interstage high-liquid-level shut-in control shall, as a minimum, be designed to shut down the compressor prime mover.

As an alternative, low-liquid-level shut-in control(s) installed in suction and interstage scrubber(s) may be designed to actuate automatic shutoff valve(s) installed in the scrubber dump line(s).

(iii) Compressor installations of 1,000 horsepower or less are excluded from those requirements of API RP 14C, A8.3d, page 54, which provide for installation of a blow-down valve on the discharge line.

(iv) Compressor installations existing prior to the effective date of this Order, and which are installed in a building, are excluded from the requirement of API RP 14C, A8.3b, which prescribes that the check valve be located outside of the building.

(v) The automatic isolation valves installed in compressor suction and fuel gas piping shall also be actuated by shutdown of the prime mover.

(g) *Curbs, Gutters, and Drains.*

(i) Curbs, gutters, and drains shall be installed in all deck areas in a manner necessary to collect all contaminants, unless drip pans or equivalent are placed under equipment and piped to a sump which will automatically maintain the oil at a level sufficient to prevent discharge of oil into Gulf waters. Sump piles of open-ended sumps shall be used to collect only produced water and liquids from drip pans and deck drains.

(h) *Fire-fighting Systems.*

(i) A fire-fighting water system of rigid pipe with fire hose stations shall be installed and may include a fixed water spray system. Such a system shall be installed in a manner necessary to provide needed protection in areas where production-handling equipment is located. A fire-fighting system using chemicals may be used in lieu of a water system if determined to provide equivalent fire protection control.

An alternate fuel or power source shall be installed to provide continued pump operation for the system during platform shut-down, unless an alternate fire-fighting system is provided.

Portable fire extinguishers shall be located in the living quarters and other strategic areas.

A diagram of the fire-fighting system showing the location of all equipment shall be posted in a prominent place on the platform or structure.

(i) *Gas Detection System.*

(i) A diagram of the gas detection system showing the location of all gas detection points shall be posted in a prominent place on the platform or structure.

(ii) All gas detection systems shall be capable of continuously monitoring for the presence of combustible gas in the areas in which the detection devices are located. The gas detector power supply shall be from a continually energized power source.

(iii) The use of fuel gas odorant is an acceptable alternate to an automatic gas detection and alarm system in enclosed, continuously manned areas of the facility.

(j) *Electrical Equipment.* The following requirements shall be applicable to all electrical equipment and systems installed:

(i) All engines shall be equipped with a low-tension ignition system of a low-fire-hazard type and shall be designed and maintained to minimize release of sufficient electrical energy to cause ignition of an external combustible mixture.

(ii) All electrical generators, motors, and lighting systems shall be installed, protected, and maintained in accordance with the edition of the National Electrical Code and API RP 500 B in effect at the time of installation.

(iii) Wiring methods which conform to the National Electrical Code or to IEEE 45, "Recommended Practice for Electric Installations on Shipboard," in effect at the time of installation, are acceptable.

(iv) An auxiliary power supply shall be installed to provide emergency power capable of operating all electrical equipment required to maintain safety of operations in the event of a failure in the primary electrical power supply.

(k) *Erosion.* A program of erosion control shall be in effect for wells having a history of sand production. The erosion control program may include sand probes, X-ray, ultrasonic, or other satisfactory monitoring methods. An annual report, by lease, on the results of the program shall be submitted by the first of September to the appropriate District Supervisor.

(2) *Operations.*

(a) Any device on wells, vessels, or flowlines temporarily out of service shall be flagged. Safety devices and systems on wells which are capable of producing shall not be bypassed or blocked out of service unless necessary during start-up or maintenance operations and then only with personnel on duty aboard the platform.

(b) When wells are disconnected from producing facilities and blind flanged or equipped with a tubing plug, compliance is not required with provisions of API RP 14C and of this Order concerning (a) installation of automatic fail-close surface safety valves on wellhead assemblies, (b) installation of high- and low-pressure shut-in sensors downstream of the well choke in flowlines from wells, and (c) installation of check valves in header individual flowlines. All opened lines connected to producing facilities shall be plugged or blind-flanged.

(c) Simultaneous Operations. Prior to conducting activities, simultaneously with production operations, which could increase the possibility of occurrence of undesirable events such as harm to personnel or to the environment, or damage to equipment, an operator's Contingency Plan shall be filed for approval by the appropriate District Supervisor. The plan shall be filed within 90 days after the effective date of this Order. Activities requiring the plan are drilling, workover, wireline, and major construction operations. The plan shall include:

(i) A narrative description of operations.

(ii) Schematic plans showing areas of activities.

(iii) Identification of critical areas of simultaneous activities.

(iv) Procedures for mitigation of potential undesirable events including:

(a) The guidelines the operator will follow to assure coordination and control of simultaneous activities.

(b) Indication as to the person having overall responsibility, as person in charge at the site, for safety of platform operations.

(c) An outline of any additional safety measures that are required for simultaneous operations.

(d) Specification of any added or special equipment or procedural conditions imposed when simultaneous activity is in progress.

(d) Welding Practices and Procedures. The following requirements shall apply to all platforms and structures, including mobile drilling and workover structures. These requirements shall apply to fixed structures after the drilling out of the drive or structural casing for the first well drilled on the structure, entry into a well to be tied back to the structure, or first flow of combustible fluids to the structure. The period of time during which these requirements are considered applicable to mobile drilling structures is the interval from the drilling out of the drive or structural casing until the blowout-preventer stack and riser are pulled in the final abandoment, suspension, or completion. These requirements shall apply to workover rigs when such rigs are performing remedial work on any wells open to hydrocarbon-bearing zones.

For the purpose of this Order, the term "welding and burning" is defined to include arc or acetylene cutting and arc or acetylene welding.

Each operator shall file for approval by the appropriate District Supervisor a Welding and Burning Safe Practices and Procedures Plan. The plan shall be filed within 90 days after the effective date of this Order and shall include company qualification standards or requirements for personnel and the methods by which the operator will assure that only personnel meeting such standards or requirements are utilized. A copy of this plan shall be available in the field. Any person designated as a welding supervisor shall be thoroughly familiar with this plan.

Prior to welding or burning operations, the operator shall establish approved safe welding areas. Such areas shall be constructed of noncombustible or fire-resistant materials free of combustible or flammable contents and be suitably segregated from adjacent areas. National Fire Protection Association Bulletin No.

51B, "Cutting and Welding Processes," 1971, shall be used as a guide to designate these areas. All welding which cannot be done in the approved safe welding area shall be performed in compliance with the procedures outlined below:

(i) Such welding and burning as are necessary on a structure shall adhere to the following practices:

(a) Prior to the commencement of any welding or burning operations on a structure, the operator's designated welding supervisor at the installation shall personally inspect the qualifications of the welder or welders to assure that they are properly qualified in accordance with the approved company qualification standards or requirements for welders. The designated welding supervisor and welders shall personally inspect the area in which the work is to be performed for potential fire and explosion hazards. After it has been determined that it is safe to proceed with the welding or burning operation, the welding supervisor shall issue a written authorization for the work.

(b) All welding equipment shall be inspected prior to beginning any welding or burning. Welding machines located on production or process platforms shall be equipped with spark arrestors and drip pans. Welding leads shall be completely insulated and in good condition; oxygen and acetylene bottles secured in a safe place; and hoses leak-free and equipped with proper fittings, gauges, and regulators.

(c) During all welding and burning operations, one or more persons as necessary shall be designated as a Fire Watch. Persons assigned as a Fire Watch shall have no other duties while actual welding or burning operations are in progress.

(d) Prior to any welding or burning, the Fire Watch shall have in his possession firefighting equipment in a condition ready to use.

(e) No welding shall be done on containers, tanks, or other vessels which have contained a flammable substance unless the contents of the vessels have been rendered inert and determined to be safe for welding or burning by the designated welder supervisor.

(f) In the event drilling, workover, or wireline operations are in progress on the platform, welding operations in other than approved safe welding areas may be conducted only if the well(s) on which work is being done contain noncombustible fluids, and entry of formation hydrocarbons into the wellbore is precluded by a positive overbalance toward the formation. Also, all other provisions of this section shall be applicable.

(g) All other producible wells shall be shut-in at the surface safety valves while welding or burning in the wellhead or production area.

(3) *Testing*. The safety system devices required by this Order shall be tested by the operator at the interval specified below or more frequently if operation conditions warrant. Records shall be maintained at the field office for a period of one year, showing the present status and component history of each device, including dates and details of inspection, testing, repairing, adjustment, and reinstallation. Such records shall be available to any authorized representative of the Geological Survey. Records shall be analyzed, equipment or system problems areas identified, and action taken to preclude recurrence of problems.

Testing and reporting shall be accomplished in accordance with API RP 14C, Appendix D, and the following:

(a) All pressure relief valves shall be tested for operation annually. Pressure relief valves shall be either bench-tested or equipped to permit testing with an external pressure source.

(b) All pressure sensors shall be tested at least once each calendar month, but at no time shall more than six weeks elapse between tests.

(c) All automatic wellhead safety devices and check valves on all flowlines shall be checked for operation and holding pressure once each calendar month, but at no time shall more than six weeks elapse between tests. If any wellhead safety valve indicates leakage, it shall be repaired or replaced.

(d) All liquid-level shut-in controls shall be tested at least once within each calendar month, but at no time shall more than six weeks elapse between tests. These tests shall be conducted by raising or lowering the liquid level across the level-control detector.

(e) All automatic inlet shutoff valves actuated by a sensor on a vessel or a compressor shall be tested for operation at least once within each calendar month, but at no time shall more than six weeks elapse between tests.

(f) All automatic shutoff valves located in liquid discharge lines and actuated by vessel low-level sensors shall be tested for operation once within each calendar month, but at no time shall more than six weeks elapse between tests.

(g) The high-temperature shutdown controls installed in all compressors which are protected against abnormal pressures solely by such temperature safety devices shall be tested annually and repaired or replaced as necessary.

(h) All pumps for fire-fighting water systems shall be inspected and test-operated weekly. A record of the tests shall be maintained at the field office for a period of one year.

(i) The Automatic Gas Detection System shall be tested for operation and recalibrated every six months.

(4) *Training*. Not later than two years after the effective date of this Order, the operator shall ensure that all personnel engaged in installing, inspecting, testing, and routinely maintaining these safety devices will have been qualified under a program as recommended by API RP T-2, September 1974, amended November 1975, or an equivalent program, approved by the Geological Survey. Documented evidence of qualification of individuals performing these functions shall be maintained at the work site and shall be available to any authorized representative of the Geological Survey.

Not later than one year after the effective date of this Order, the operator shall submit for approval, a description of the training to be conducted and the methods the operator will utilize to ensure that only persons qualified as above perform these functions. The description shall include:

(a) The operator organizational element responsible for training and to interface with the Geological Survey in training program matters.

(b) Categories of personnel to be qualified.

(c) Training organizations and courses to be utilized.

(d) Method of ensuring qualification of third-party personnel, if utilized.

(e) Method for determining when additional training or requalification is required and for obtaining same.

(f) Method of monitoring operations to ensure that only qualified personnel perform functions.

(g) Method of maintaining documented evidence of qualification at work site.

5. *Crane Operations*. Cranes shall be operated and maintained in a manner necessary to ensure the safety of facility operations in accordance with the provisions of API RP 2D, "Operation and Maintenance of Offshore Cranes," October 1972.

Records of inspection, testing, and maintenance shall be kept in the field office for a period of one year.

API Specification 2C, "Specification for Offshore Cranes," February 1972, shall be used as a guideline for the selection of cranes to be used offshore.

6. *Employee Orientation and Motivation Programs for Personnel Working Offshore*. The operator shall make a planned, continuing effort to eliminate accidents due to human error. This effort shall include the training of personnel in operational aspects of their functions and a program to instill in each individual working offshore a conscious desire to achieve safe and pollution-free operations. Minimum training of personnel going offshore for the first time shall include an orientation per API RP T–1, "Orientation Program for Personnel Going Offshore the First Time," January 1974, or equivalent. API Bulletin T–5, "Employee Motivation Programs for Safety and Prevention of Pollution in Offshore Operations," September 1974, shall be used as a guide in developing employee safety and pollution-prevention motivation programs.

7. *Requirements for Drilling Rigs*. The requirements of subparagraphs 4.D.(1)(g), 4.D.(1)(j), 4.D.(2)(d), and paragraphs 5. and 6. above shall apply to all drilling rigs used to conduct drilling or workover operations on Federal leases in the Gulf of Mexico.

/s/ D. W. SOLANAS
*Oil and Gas Supervisor*
*Field Operations*
*Gulf of Mexico Area*

APPROVED:

/s/ RUSSELL G. WAYLAND
*Chief, Conservation Division*

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# UNITED STATES DEPARTMENT OF THE INTERIOR
# GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

## OCS ORDER NO. 9
*Effective October 30, 1970*

### OIL AND GAS PIPELINES

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.19(b). Section 250.19(b) provides as follows:

> (b) The Supervisor is authorized to approve the design, other features, and plan of installation of all pipelines for which a right of use or easement has been granted under Paragraph (c) of Section 250.18 or authorized under any lease issued or maintained under the Act, including those portions of such lines which extend onto or traverse areas other than the Outer Continental Shelf.

The operator shall comply with the following requirements. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *General Design.* All pipelines shall be designed and maintained in accordance with the following:

A. The operator shall be responsible for the installation of the following control devices on all oil and gas pipelines connected to a platform including pipelines which are not operated or owned by the operator. Operators of platforms installed prior to the effective date of this Order shall comply with the requirements of subparagraphs (1) and (2) within six months of the effective date of this Order. The operator shall submit records semi-annually showing the present status and past history of each device, including dates and details of inspection, testing, repairing, adjustment, and reinstallation.

(1) All oil and gas pipelines leaving a platform receiving production from the platform shall be equipped with a high-low pressure sensor to directly or indirectly shut-in the wells on the platform.

(2) (a) All oil and gas pipelines delivering production to production facilities on a platform shall be equipped with an automatic shut-in valve connected to the platform's automatic and remote shut-in system.

(b) All oil and gas pipelines coming onto a platform shall be equipped with a check valve to avoid backflow.

(c) Any oil or gas pipelines crossing a platform which do not deliver production to the platform, but which may or may not receive production from the platform, shall be equipped with high-low pressure sensors to activate an automatic shut-in valve to be located in the upstream portion of the pipeline at the platform. This automatic shut-in valve shall be connected to either the platform automatic and remote shut-in system or to an independent remote shut-in system.

(d) All pipeline pumps shall be equipped with high-low pressure shut-in devices.

B. All pipelines shall be protected from loss of metal by corrosion that would endanger the strength and safety of the lines either by providing extra metal for corrosion allowance, or by some means of preventing loss of metal such as protective coatings or cathodic protection.

C. All pipelines shall be installed and maintained to be compatible with trawling operations and other uses.

D. All pipelines shall be hydrostatically tested to 1.25 times the designed working pressure for a minimum of 2 hours prior to placing the line in service.

E. All pipelines shall be maintained in good operating condition at all times and inspected monthly for indication of leakage using aircraft, floating equipment, or other methods. Records of these inspections including the date, methods, and results of each inspection shall be maintained by the pipeline operator and submitted annually by April 1. The pipeline operator shall submit records indicating the cause, effect, and remedial action taken regarding all pipeline leaks within one week following each such occurrence.

F. All pipelines shall be designed to be protected against water currents, storm scouring, soft bottoms, and other environmental factors.

2. *Application.* The operator shall submit in duplicate the following to the Supervisor for approval:

A. Drawing on 8″ × 10½″ plat or plats showing the major features and other pertinent data including: (1) water depth, (2) route, (3) location, (4) length, (5) connecting facilities, (6) size, and (7), burial depth, if buried.

B. A schematic drawing showing the following pipeline safety equipment and the manner in which the equipment functions: (1) high-low pressure sensors, (2) automatic shut-in valves, and (3) check valves.

C. General information concerning the pipeline including the following:

(1) Product or products to be transported by the pipeline.

(2) Size, weight, and grade of the pipe.

(3) Length of line.

(4) Maximum water depth.

(5) Type or types of corrosion protection.

(6) Description of protective coating.

(7) Bulk specific gravity of line (with the line empty).

(8) Anticipated gravity or density of the product or products.

(9) Design working pressure and capacity.

(10) Maximum working pressure and capacity.

(11) Hydrostatic pressure and hold time to which the line will be tested after installation.

(12) Size and location of pumps and prime movers.

(13) Any other pertinent information as the Supervisor may prescribe.

3. *Completion Report.* The operator shall notify the Supervisor when installation of the pipeline is completed and submit a drawing on 8″ × 10″ plats showing the location of the line as installed, accompanied by all hydrostatic test data including procedure, test pressure, hold time, and results.

/s/ ROBERT F. EVANS
*Supervisor*

APPROVED: OCTOBER 30, 1970

/s/ RUSSELL G. WAYLAND
*Chief, Conservation Division*

# UNITED STATES DEPARTMENT OF THE INTERIOR
# GEOLOGICAL SURVEY—CONSERVATION DIVISION
## GULF OF MEXICO AREA

# OCS ORDER NO. 10

*Effective August 28, 1969*

## SULPHUR DRILLING PROCEDURES

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.34, 250.41, and 250.91. All exploratory core holes for sulphur and all sulphur development wells shall be drilled in accordance with the provisions of this Order, except that development wells shall be drilled in accordance with field rules when established by the supervisor. Each Application to Drill (Form 9–331C) shall include all information required under 30 CFR 250.91 and the integrated casing, cementing, mud, and blowout prevention program for the well. The operator shall comply with the following requirements. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *Well Casing and Cementing.* All wells shall be cased and cemented in accordance with the requirements of 30 CFR 250.41(a)(1). Special consideration to casing design shall be given to compensate for effects caused by subsidence, corrosion, and temperature variation. All depths refer to true vertical depth (TVD).

A. *Drive or Structural Casing.* This casing shall be set by drilling, driving, or jetting to a minimum depth of 100 feet below the Gulf floor, or to such greater depth required to support unconsolidated deposits and to provide hole stability for initial drilling operations. If drilled in, the drilling fluid shall be a type that will not pollute the Gulf, and a quantity of cement sufficient to fill the annular space back to the Gulf floor must be used.

B. *Conductor Casing.* This casing shall be set and cemented before drilling into shallow formations known to contain hydrocarbons or, if unknown, upon encountering such formations. Conductor casing shall extend to a depth of not less than 350 feet nor more than 750 feet below the Gulf floor. A quantity of cement sufficient to fill the annular space back to the Gulf floor must be used. The cement may be washed out or displaced to a depth of 40 feet below the Gulf floor to facilitate casing removal upon well abandonment.

C. *Caprock Casing.* This casing shall be set at the top of the caprock and be cemented with a quantity of cement sufficient to fill the annular space back to the Gulf floor. Stage cementing or other cementing method shall be used to insure cement returns to the Gulf floor.

2. *Blowout Prevention Equipment.* Blowout preventers and related well control equipment shall be installed, used, and tested in a manner necessary to prevent blowouts. Prior to drilling below the conductor casing, blowout prevention equipment shall be installed and maintained ready for use until drilling operations are completed, as follows:

A. *Conductor Casing.* Before drilling below this string, at least one remotely controlled bag-type blowout preventer and equipment for circulating the drilling fluid to the drilling structure or vessel shall be installed. To avoid formation fracturing from complete shut-in of the well, a large diameter pipe with control valves shall be installed on the conductor casing below the blowout preventer so as to permit the diversion of hydrocarbons and other fluids; except that when the blowout preventer assembly is on the Gulf floor, the choke and kill lines shall be equipped to permit the diversion of hydrocarbons and other fluids.

B. *Caprock Casing.* Before drilling below this string, the blowout prevention equipment shall include a minimum of: (1) three remotely controlled, hydraulically operated, blowout preventers with a working pressure which exceeds the maximum anticipated surface pressure, including one equipped with pipe rams, one with blind rams, and one bag-type; (2) a drilling spool with side outlets, if side outlets are not provided in the blowout preventer body; (3) a choke manifold; (4) a kill line; and (5) a fill-up line.

C. *Testing.* Ram-type blowout preventers and related control equipment shall be tested with water to the rated working pressure of the stack assembly, or to the working pressure of the casing, whichever is the lesser, (1) when installed; (2) before drilling out after each string of casing is set; (3) not less than once each week while drilling; and (4) following repairs that require disconnecting a pressure seal in the assembly. The bag-type blowout preventer shall be tested to 70 percent of the above pressure requirements.

While drill pipe is in use ram-type blowout preventers shall be actuated to test proper functioning once each day. The bag-type blowout preventer shall be actuated on the drill pipe once each week. Accumulators or accumulators and pumps shall maintain a pressure capacity reserve at all times to provide for repeated operation of hydraulic preventers. A blowout prevention drill shall be conducted weekly for each drilling crew to insure that all equipment is operational and that crews are properly trained to carry out emergency duties. All blowout preventer tests and crew drills shall be recorded on the driller's log.

D. *Other Equipment.* A drill string safety valve in the open position shall be maintained on the rig floor at all times while drilling operations are being conducted. Separate valves shall be maintained on the rig floor to fit all pipe in the drill string. A Kelly cock shall be installed below the swivel.

3. *Mud Program—General.* The characteristics, use, and testing of drilling mud and the conduct of related drilling procedures shall be such as are necessary to prevent the blowout of any well. Quantities of mud materials sufficient to insure well control shall be maintained readily accessible for use at all times. The following mud control and testing equipment requirements are applicable to operations conducted prior to drilling below the caprock casing.

A. *Mud Control.* Before starting out of the hole with drill pipe, the mud shall be circulated with the drill pipe just off bottom until the mud is properly conditioned. When coming out of the hole with drill pipe, the annulus shall be filled with mud before the mud level drops below 100 feet, and a mechanical device for measuring the amount of mud required to fill the hole shall be utilized. The volume of mud required to fill the hole shall be watched, and any time there is an indication of swabbing, or influx of formation fluids, the drill pipe shall be run to bottom, and the mud properly conditioned. The mud shall not be circulated and conditioned except on or near bottom, unless well conditions prevent running the pipe to bottom.

B. *Mud Testing and Equipment.* Mud testing equipment shall be maintained on the drilling platform at all times, and mud tests shall be performed daily, or more frequently as conditions warrant.

The following mud system monitoring equipment must be installed (with derrick floor indicators) and used throughout the period of drilling after setting and cementing the conductor casing:

(1) Recording mud pit level indicator to determine mud pit volume gains and losses. This indicator shall include a visual or audio warning device.

(2) Mud volume measuring device for accurately determining mud volumes required to fill the hole on trips.

(3) Mud return indicator to determine that returns essentially equal the pump discharge rate.

/s/ ROBERT F. EVANS
*Supervisor*

APPROVED: AUGUST 28, 1969

/s/ RUSSELL G. WAYLAND
*Chief, Conservation Division*

# UNITED STATES DEPARTMENT OF THE INTERIOR
# GEOLOGICAL SURVEY—CONSERVATION DIVSION

GULF OF MEXICO AREA

## OCS ORDER NO. 11

*Effective May 1, 1974*

### OIL AND GAS PRODUCTION RATES, PREVENTION OF WASTE, AND PROTECTION OF CORRELATIVE RIGHTS

This Order is established pursuant to the authority prescribed in 30 CFR 250.1, 30 CFR 250.11, and in accordance with all other applicable provisions of 30 CFR Part 250, and the notice appearing in the Federal Register, dated December 5, 1970 (35 F.R. 18559), to provide for the prevention of waste and conservation of the natural resources of the Outer Continental Shelf, and the protection of correlative rights therein. This Order shall be applicable to all oil and gas wells on Federal leases in the Outer Continental Shelf of the Gulf of Mexico; provided, however, that it shall not apply to oil and gas wells on a lease of which any part lies within the disputed area referred to in paragraph 4 of the Supplemental Decree of December 20, 1971, in United States vs. Louisiana, et al., 404 U.S. 388 (1971). All departures from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 250.12(b). References in this Order to approvals, determinations, and requirements for submittal of information or applications for approval are to those granted, made, or required by the Oil and Gas Supervisor or his delegated representative.

1. *Definition of Terms.* As used in this Order, the following terms shall have the meanings indicated:

A. *Waste of Oil and Gas.* The definition of waste appearing in 30 CFR 250.2(h) shall apply, and includes the failure to timely initiate enhanced recovery operations where such methods would result in an increased ultimate recovery of oil or gas under sound engineering and economic principles. Enhanced recovery operations refers to pressure maintenance operations, secondary and tertiary recovery, cycling, and similar recovery operations which alter the natural forces in a reservoir to increase the ultimate recovery of oil or gas.

B. *Correlative Rights.* The opportunity afforded each lessee or operator to produce without waste his just and equitable share of oil and gas from a common source of supply.

C. *Maximum Efficient Rate (MER).* The maximum sustainable daily oil or gas withdrawal rate from a reservoir which will permit economic development and depletion of that reservoir without detriment to ultimate recovery.

D. *Maximum Production Rate (MPR).* The approved maximum daily rate at which oil may be produced from a specified oil well completion or the maximum approved daily rate at which gas may be produced from a specified gas well completion.

E. *Interested Parts.* The operators and lessees, as defined in 30 CFR 250.2(f) and (g), of the lease or leases involved in any proceeding initiated under this Order.

F. *Reservoir.* An oil or gas accumulation which is separated from and not in oil or gas communication with any other such accumulation.

G. *Competitive Reservoir.* A reservoir as defined herein containing one or more producible or producing well completions on each of two or more leases, or portions thereof, in which the lease or operating interests are not the same.

H. *Property Line.* A boundary dividing leases, or portions thereof, in which the lease or operating interest is not the same. The boundaries of Federally approved unit areas shall be considered property lines. The boundaries dividing leased and unleased acreage shall be considered property lines for the purpose of this Order.

I. *Oil Reservoir.* A reservoir that contains hydrocarbons predominantly in a liquid (single-phase) state.

J. *Oil Well Completion.* A well completed in an oil reservoir or in the oil accumulation of an oil reservoir with an associated gas cap.

K. Gas Reservoir. A reservoir that contains hydrocarbons predominantly in a gaseous (single-phase) state.

L. *Gas Well Completion.* A well completed in a gas reservoir or in the gas cap of an oil reservoir which an associated gas cap.

M. *Oil Reservoir with an Associated Gas Cap.* A reservoir that contains hydrocarbons in both a liquid and a gaseous state (two-phase).

N. *Producible Well Completion.* A well which is physically capable of production and which is shut in at the wellhead or at the surface, but not necessarily connected to production facilities, and from which the operator plans future production.

2. *Classification of Reservoirs.*

A. *Initial Classification.* Each producing reservoir shall be classified by the operator, subject to approval by the Supervisor, as an oil reservoir, an oil reservoir with an associated gas cap, or a gas reservoir.

(1) The initial classification of each reservoir from which production is commenced subsequent to the date of this Order shall be submitted for approval with the initial submittal of MER data for the reservoir.

(2) Each reservoir from which production commenced on or prior to the date of this Order shall be classified by the operator, based on existing reservoir conditions. Such classification shall be determined and submitted to the Supervisor within six (6) months of the date of this Order.

B. *Reclassification.* A reservoir may be reclassified by the Supervisor, on his own initiative or upon application of an operator, during its productive life when information becomes available showing that such reclassification is warranted.

3. *Oil and Gas Production Rates.*

A. *Maximum Efficient Rate (MER).* The operator shall propose a maximum efficient rate (MER) for each producing reservoir based on sound engineering and economic principles. When approved at the proposed or other rate, such rate shall not be exceeded, except as provided in paragraph 4 of this Order.

(1) *Submittal of Initial MER.* Within 45 days after the date of first production or such longer period as may be approved, the operator shall submit a Request for Reservoir MER (Form 9-1866) with appropriate supporting information.

(2) *Revision of MER.* The operator may request a revision of an MER by submitting the proposed revision to the Supervisor on a Request for Reservoir MER (Form 9-1866) with appropriate supporting information. The Operator shall obtain approval to produce at test rates which exceed an approved MER when such testing is necessary to substantiate an increase in the MER.

(3) *Review of MER.* The MER for each reservoir will be reviewed by the operator annually, or at such other required or approved interval of time. The results of the review, with all current supporting information, shall be submitted on a Request for Reservoir MER (Form 9-1866).

(4) *Effective Date of MER.* The effective date of an MER, or revision thereof, will be determined by the Supervisor and shown on a Request for Reservoir MER (Form 9-1866) when the MER is approved. The effective date for an initial MER shall be the first day following the completion of an approved testing period. The effective date for a revised MER shall be the first day following the completion of an approved testing period, or if testing is not conducted, the date the revision is approved.

B. *Maximum Production Rate (MPR).* The operator shall propose a maximum production rate (MPR) for each producing well completion in a reservoir together with full information on the method used in its determination. When an MPR has been approved for a well completion, that rate shall not be exceeded, except as provided in paragraph 4 of this Order. The MPR shall be based on well tests and any limitations imposed by (1) well tubing, safety equipment, artificial lift equipment, surface back pressure, and equipment capacity; (2) sand producing problems; (3) producing gas-oil and water-oil ratios; (4) relative structural position of the well with respect to gas-oil or water-oil contacts; (5) position of perforated interval within total production zone; and (6) prudent operating practices. The MPR established for each well completion shall not exceed 110 percent of the rate demonstrated by a well test unless justified by supporting information.

(1) *Submittal of Initial MPR.* The operator shall have 30 days from the date of first continuous production within which to conduct a potential test, as specified under subparagraphs 5.B and 6.B of this Order, on all new and reworked well completions. Within 15 days after the date of the potential test, the operator shall submit a proposed MPR for the individual well

completion on a Request for Well Maximum Production Rate (MPR) (Form 9-1867), with the results of the potential test on a Well Potential Test Report (Form 9-1868). Extension of the 30-day test period may be granted. The effective date for any approved initial MPR shall be the first day following the test period. During the 30-day period allowed for testing, or any approved extensions thereof, the operator may produce a new or reworked well completion at rates necessary to establish the MPR. The operator shall report the total production obtained during the test period, and approved extensions thereof, on the Well Potential Test Report (Form 9-1868).

(2) *Revision of MPR Increase.* If necessary to test a well completion at rates above the approved MPR to determine whether the MPR should be increased, notification of intent to test the well at such higher rates, not to exceed a stated maximum rate during a specified test period, shall be filed with the Supervisor. Such tests may commence on the day following the date of filing notification, unless otherwise ordered by the Supervisor. If an operator determines that the MPR should be increased, he shall submit, within 15 days after the specified test period, a proposed increased MPR on a Request for Well Maximum Production Rate (MPR) (Form 9-1867), and any other available data to support the requested revision, including the results of the potential test and the total production obtained during the test period on a Well Potential Test Report (Form 9-1868). Prior to approval of the proposed increased MPR, the operator may produce the well completion at a rate not to exceed the proposed increased MPR of the well. The effective date for any approved increased MPR shall be the first day following the test period. If testing rates or increased MPR rates result in production from the reservoir in excess of the approved MER, this excess production shall be balanced by underproduction from the reservoir under the provisions of subparagraph 4.B of this Order.

(3) *Revision of MPR Decrease.* When the quarterly test rate for an oil well completion or the semiannual test rate for a gas well completion required under subparagraphs 5.C and 6.C of this Order is less than 90 percent of the existing approved MPR for the well, a new reduced MPR will be established automatically for that well completion equal to 110 percent of the test rate submitted. The effective date for the new MPR for such well completion shall be the first day of the quarter following the required date of submittal of periodic well-test results under subparagraphs 5.C and 6.C of this Order. Also, the operator may notify the Supervisor on a Request for Well Maximum Production Rate (MPR) (Form 9-1867) of, or the Supervisor may require a downward revision of a well MPR at any time when the well is no longer capable of producing its approved MPR on a sustained basis. The effective date for such reduced MPR for a well completion shall be the first day of the month following the date of notification. (4) *Continuation of MPR.* If submittal of the results of a quarterly well test for an oil completion or a semiannual well test for a gas well completion, as provided for in subparagraphs 5.C and 6.C of this Order, cannot be timely, continuation of production under the last approved MPR for the well may be authorized, provided an extension of time in which to submit the test results is requested and approved in advance.

(5) *Cancellation of MPR.* When a well completion ceases to produce, is shut in pending workover, or any other condition exists which causes the assigned MPR to be no longer appropriate, the operator shall notify the Supervisor accordingly on a Request for Well Maximum Production Rate (MPR) (Form 9-1867), indicating the date of last production from the well, and the MPR will be canceled. Reporting of temporary shut-ins by the operator for well maintenance, safety conditions, or other normal operation conditions is not required, except as is necessary for completion of the Monthly Report of Operations (Form 9-152).

C. *MER and MPR Relationship.* The withdrawal rate from a reservoir shall not exceed the approved MER and may be produced from any combination of well completions subject to any limitations imposed by the MPR established for each well completion. The rate of production from the reservoir shall not exceed the MER although the summation of individual well MPR's may be greater than the MER.

4. *Balancing of Production.*

A. *Production Variances.* Temporary well production rates resulting from normal variations and fluctuations exceeding a well MPR or reservoir MER shall not be considered a violation of this Order, and such production may be sold or transferred pursuant to paragraph 8 of this Order. However, when normal variations and fluctuations result in production in excess of a reservoir MER, any operator who is overproduced shall balance such production in accordance with subparagraph 4.B below. Such operator shall advise the Supervisor of the amount of such excess production from the reservoir for the month at the same time as Form 9-152 is filed for that month.

B. *Balancing Periods.* As of the first day of the month following the month in which this Order becomes effective, all reservoirs shall be considered in balance. Balancing periods for overproduction of a reservoir MER shall end on January 1, April 1, July 1, and October 1 of each year. If a reservoir is produced at a rate in excess of the MER for any month, the operator who is overproduced shall take steps to balance production during the next succeeding month. In any event, all overproduction shall be balanced by the end of the next succeeding quarter following the quarter in which the overproduction occurred. The operator shall notify the Supervisor at the end of the month in which he has balanced the production from an overproduced reservoir.

C. *Shut-in for Overproduction.* Any operator in an overproduction status in any reservoir for two successive quarters which has not been brought into balance within the balancing period shall be shut in from that reservoir until the actual production equals that which would have occurred under the approved MER.

D. *Temporary Shut-in.* If, as a result of storm, hurricanes, emergencies, or other conditions perculiar to offshore operations, an operator is forced to curtail or shut in production from a reservoir, the Supervisor may, on request, approve makeup of all or part of this production loss.

5. *Oil Well Testing Procedures.*

A. *General.* Tests shall be conducted for not less than four consecutive hours. Immediately prior to the 4-hour test period, the well completion shall have produced under stabilized conditions for a period of not less than six consecutive hours. The 6-hour pretest period shall not begin until after recovery of a volume of fluid equivalent to the amount of fluids introduced into the formation for any purpose. Measured gas volumes shall be adjusted to the standard conditions of 15.015 psia and 60°F. for all tests. When orifice meters are used, a specific gravity shall be obtained or estimated for the gas and a specific gravity correction factor applied to the orifice coefficient. The Supervisor may require a prolonged test or retest of a well completion if such test is determined to be necessary for the establishment of a well MPR or a reservoir MER. The Supervisor may approve test periods of less than four hours and pretest stabilization periods of less than six hours for well completions, provided that test reliability can be demonstrated under such procedures.

B. *Potential Test.* Test data to establish or to increase an oil well MPR shall be submitted on a Well Potential Test Report (Form 9-1868). The total production obtained from all tests during the test period shall be reported on such form.

C. *Quarterly Test.* Tests shall be conducted on each producing oil well completion quarterly, and test results shall be submitted on a Quarterly Oil Well Test Report (Form 9-1869). Testing periods and submittal dates shall be as follows:

| Testing Period | Latest Date for Submittal of Test Results | For Quarter Beginning |
|---|---|---|
| Sept. 11—Dec. 10 | Dec. 10 | Jan. 1 |
| Dec. 11—Mar. 10 | Mar. 10 | April 1 |
| Mar. 11—June 10 | June 10 | July 1 |
| June 11—Sept. 10 | Sept. 10 | Oct. 1 |

There shall be a minimum of 45 days between quarterly tests for an oil well completion.

6. *Gas Well Testing Procedures.*

A. *General.* Testing procedures for gas well completions shall be the same as those specified for oil well completions in subparagraph 5.A except for the initial test which shall be a multi-point back-pressure test as described in paragraph 6.D.

B. *Potential Test.* Test data to establish or to increase a gas well MPR shall be submitted on a Well Potential Test Report (Form 9-1868).

C. *Semiannual Test.* Tests shall be conducted on each producing gas well completion semiannually, and test results shall be submitted on a Semiannual Gas Well Test Report (Form 9-1870). Testing periods and submittal dates shall be as follows:

| Testing Period | For Submittal of Test Results | For Semi-Annual Period Beginning |
|---|---|---|
| June 11—Dec. 10 | Dec. 10 | Jan. 1 |
| Dec. 11—June 10 | June 10 | July 1 |

There shall be a minimum of 90 days between semiannual tests for a gas well completion.

D. *Back-Pressure Tests.* A multi-point back-pressure test to determine the theoretical open-flow potential of gas wells shall be conducted within thirty days after connection to a pipeline. If bottom-hole pressures are not measured, such pressures shall be calculated from surface pressures using the method, or other similar method, found in the Interstate

Oil Compact Commission (IOCC) Manual of Back-Pressure Testing of gas wells. The results of all back-pressure tests conducted by the operator shall be filed with the Supervisor, including all basic data used in determining the test results. The Supervisor may waive this requirement if multi-point back-pressure test information has previously been obtained on a representative number of wells in a reservoir.

7. *Witnessing Well Tests*. The Supervisor may have a representative witness any potential or periodic well tests on oil and gas well completions. Upon request, an operator shall notify the appropriate District office of the time and date of well tests.

8. *Sale or Transfer of Production*. Oil and gas produced pursuant to the provisions of this Order, including test production, may be sold to purchasers or transferred as production authorized for disposal hereunder.

9. *Bottom-Hole Pressure Tests*. Static bottom-hole pressure tests shall be conducted annually on sufficient key wells to establish an average reservoir pressure in each producing reservoir unless a different frequency is approved. The Operator may be required to test specific wells. Results of bottom-hole pressure tests shall be submitted within 60 days after the date of the test.

10. *Flaring and Venting of Gas*. Oil- and gas-well gas shall not be flared or vented, except as provided herein.

A. *Small-Volume of Short-Term Flaring or Venting*. Oil- and gas-well gas may be flared or vented in small volumes or temporarily without the approval of the Supervisor in the following situations:

(1) *Gas Vapors*. When gas vapors are released from storage and other low-pressure production vessels if such gas vapors cannot be economically recovered or retained.

(2) *Emergencies*. During temporary emergency situations, such as compressor or other equipment failure, or the relief of abnormal system pressures.

(3) *Well Purging and Evaluation Tests*. During the unloading or cleaning up of a well and during drillstem, producing, or other well evaluation tests not exceeding a period of 24 hours.

B. *Approval for Routine or Special Well Tests*. Oil- and gas-well gas may be flared or vented during routine and special well tests, other than those described in paragraph A above, only after approval of the Supervisor.

C. *Gas-Well Gas*. Except as provided in A and B above, gas-well gas shall not be flared or vented.

D. *Oil-Well Gas*. Except as provided in A and B above, oil-well gas shall not be flared or vented unless approved by the Supervisor. The Supervisor may approve an application for flaring or venting of oil-well gas for periods not exceeding one year if (1) the operator has initiated positive action which will eliminate flaring or venting, or (2) the operator has submitted an evaluation supported by engineering, geologic, and economic data indicating that rejection of an application to flare or vent the gas will result in an ultimate greater loss or equivalent total energy than could be recovered for beneficial use from the lease if flaring or venting were allowed.

E. *Content of Application*. Applications under paragraph D above for existing operations, as of the date of this Notice, shall be filed within three months from the effective date of this Order. Applications under paragraph D(2) above shall include all appropriate engineering, geologic, and economic data in an evaluation showing that absence of approval to flare or vent the gas will result in premature abandonment of oil and gas production or curtailment of lease development. Applications shall include an estimate of the amount and value of the oil and gas reserves that would not be recovered if the application to flare or vent were rejected and an estimate of the total amount of oil to be recovered and associated gas that would be flared or vented if the application were approved.

11. *Disposition of Gas*. The disposition of all gas produced from each lease shall be reported monthly on, or attached to, Form 9-152. The report shall be submitted in the following manner:

| | Oil-Well Gas (MCF) | Gas-Well Gas (MCF) |
|---|---|---|
| Sales | | |
| Fuel | | |
| *Injected | | |
| Flared | | |
| Vented | | |
| Other (Specify) | | |
| Total | | |

*Gas produced from the lease and injected on or off the lease.

12. *Multiple and Selective Completions*.

A. *Number of Completions*. A well bore may contain any number of producible completions when justified and approved.

B. *Numbering Well Completions*. Well completions made after the date of this Order shall be designated using numerical and alphabetical nomenclature. Once designated as a reservoir completion, the well completion number shall not change. Appendix A contains a detailed explanation of procedures for naming well completions.

C. *Packer Tests*. Multiple and selective completions shall be equipped to isolate the respective producing reservoirs. A packer test or other appropriate reservoir isolation test shall be conducted prior to or immediately after initiating production and annually thereafter on all multiply completed wells. Should the reservoirs in any multiply completed well become intercommunicative the operator shall make repairs and again conduct reservoir isolation tests unless some other operational procedure is approved. The results of all tests shall be submitted on a Packer Test (Form 9-1871) within 30 days after the date of the test.

D. *Selective Completions*. Completion equipment may be installed to permit selective reservoir isolation or exposure in a well bore through wireline or other operations. All selective completions shall be designated in accordance with subparagraph 12.B when the application for approval of such completions is filed.

E. *Commingling*. Commingling of production from two or more separate reservoirs within a common well bore may be permitted if it is determined that, collectively, the ultimate recovery will not be decreased. An application to commingle hydrocarbons from multiple reservoirs within a common well bore shall be submitted for approval and shall include all pertinent well information, geologic and reservoir engineering data, and a schematic diagram of well equipment. For all competitive reservoirs, notice of the application shall be sent by the applicant to all other operators of interest in the reservoirs prior to submitting the application to the Supervisor. The application shall specify the well completion number to be used for subsequent reporting purposes.

13. *Gas-Cap Well Completions*. All existing and future wells completed in the gas cap of a reservoir which has been classified and approved as an associated oil reservoir shall be shut in until such time as the oil is depleted or the reservoir is reclassified as a gas reservoir; provided, however, that production from such wells may be approved when (1) it can be shown that such gas-cap production would not lead to waste of oil and gas, or (2) when necessary to protect correlative rights unless it can be shown that this production will lead to waste of oil and gas.

143. *Location of Wells*.

A. *General*. The location and spacing of all exploratory and development wells shall be in accordance with approved programs and plans required in 30 CFR 250.17 and 250.34. Such location and spacing shall be determined independently for each lease or reservoir in a manner which will locate wells in the optimum structural position for the most effective production of reservoir fluids and to avoid the drilling of unnecessary wells.

B. *Distance from Property Line*. An operator may drill exploratory or development wells at any location on a lease in accordance with approved plans; provided that no well directionally or vertically drilled and completed after the date of this Order in which the completed interval is less than 500 feet from a property line shall be produced unless approved by the Supervisor.

For wells drilled as vertical holes, the surface location of the well shall be considered as the location of the completed interval but shall be subject to the provisions of 30 CFR 250.40(b). An operator requesting approval to produce a directionally drilled well in which the completed interval is located closer than 500 feet from a property line, or approval to produce a vertically drilled well with a surface location closer than 500 feet from a property line, shall furnish the Supervisor with letters expressing acceptance or objection from operators of offset properties.

15. *Enhanced Oil and Gas Recovery Operations*. Operators shall timely initiate enhanced oil and gas recovery operations for all competitive and noncompetitive reservoirs where such operations would result in an increased ultimate recovery of oil or gas under sound engineering and economic principles. A plan for such operations shall be submitted with the results of the annual MER review as required in paragraph 3A(3) of this Order.

16. *Competitive Reservoir Operations*. Development and production operations in a competitive reservoir may be required to be conducted under either pooling and drilling agreements or unitization agreements when the Conservation Manager determines, pursuant to 30 CFR 250.50 and delegated authority, that such agreements are practicable and necessary or advisable and in the interest of conservation.

A. *Competitive Reservoir Determination*. The Supervisor shall notify the operators when he has made a preliminary determination that a reservoir is competitive as defined in this Order. An operator may request at any time that the Supervisor make a preliminary determination as to whether a reservoir is competitive. The operators, within thirty (30) days of such preliminary notification or such extension of time as approved by the Supervisor, shall advise of their concurrence with such determination, or submit objections with supporting evidence. The Supervisor will make a final determination and notify the operators.

B. *Development and Production Plans.* When drilling and/or producing operations are conducted in a competitive reservoir, the operators shall submit for approval a plan governing the applicable operations. The plan shall be submitted within ninety (90) days after a determination by the Supervisor that a reservoir is competitive or within such extended period of time as approved by the Supervisor. The plan shall provide for the development and/or production of the reservoir, and may provide for the submittal of supplemental plans for approval by the Supervisor.

(1) *Development Plan.* When a competitive reservoir is still being developed or future development is contemplated, a development plan may be required in addition to a production plan. This plan shall include the information required in 30 CFR 250.34. If agreement to a joint development plan cannot be reached by the operators, each shall submit a separate plan and any differences may be resolved in accordance with paragraph 17 of the Order.

(2) *Production Plan.* A joint production plan is required for each competitive reservoir. This plan shall include (a) the proposed MER for the reservoir, (b) the proposed MPR for each completion in the reservoir, (c) the percentage allocation of reservoir MER for each lease involved, and (d) plans for secondary recovery or pressure maintenance operations. If agreement to a joint production plan cannot be reached by the operators, each shall submit a separate plan, and any differences may be resolved in accordance with paragraph 17 of this Order.

C. *Utilization.* The Conservation Manager shall determine when conservation will be best served by unitization of a competitive reservoir, or any reservoir reasonable delineated and determined to be productive, in lieu of a development and/or production plan or when the operators and lessees involved have been unable to voluntarily effect unitization. In such cases, the Conservation Manager may require that development and/or production operations be conducted under an approved unitization plan. Within six (6) months after notification by the Conservation Manager that such a unit plan is required, or within such extended period of time as approved by the Conservation Manager, the lessees and operators shall submit a proposed unit plan for designation of the unit area and approval of the form of agreement pursuant to 30 CFR 250.51.

17. *Conferences, Decisions and Appeals.* Conferences with interested parties may be held to discuss matters relating to applications and statements of position filed by the parties relating to operations conducted pursuant to this Order. The Supervisor or Conservation Manager may call a conference with one or more, or all, interested parties on his own initiative or at the request of any interested party. All interested parties shall be served with copies of the Supervisor's or Conservation Manager's decisions. Any interested party may appeal decisions of the Supervisor or Conservation Manager pursuant to 30 CFR 250.81. Decisions of the Supervisor or Conservation Manager shall remain in effect and shall not be suspended by reason of any appeal, except as provided in that regulation.

/s/ J. B. LOWENHAUPT
*Oil and Gas Supervisor*
*Production Control*
*Gulf of Mexico Area*

APPROVED: MAY 1, 1974

/s/ RUSSELL G. WAYLAND
*Chief, Conservation Division*

# UNITED STATES DEPARTMENT OF THE INTERIOR
# GEOLOGICAL SURVEY—CONSERVATION DIVISION
## GULF OF MEXICO AREA

# OCS ORDER NO. 11
## *APPENDIX A*

Subparagraph 12.B.: "Numbering Well Completions. Well completions made after the date of this Order shall be designated using numerical and alphabetical nomenclature. Once designated as a reservoir completion, the well completion number shall not change..."

The intent of this subparagraph is not necessarily to change the existing well completion names but to change the method of naming well completions after the effective date of this Order in order to insure that a completion in a given reservoir and a specific well bore will be assigned a unique name and will retain that name permanently. For further clarification, the following guidelines and examples are offered:

1. Each well bore will have a distinct, permanent number.
2. Each reservoir completion in a well bore will have a unique permanent designation which includes the well bore number in its nomenclature.
3. For the purpose of this subparagraph, a "completion" is defined as all perforations in a given reservoir in a specific well bore and is not necessarily associated with a tubing string or strings.
4. If more than one completion is made in a well bore, an alphabetical suffix must be used in the nomenclature to differentiate between completions.
5. An alphabetical prefix may be utilized to designate the platform from which the well will be produced.

Example No. 1: The first well drilled from the A platform is a single completion.

Well No. A-1

(Should an operator wish to use an alphabetical suffix with a single completion, he may do so.)

Example No. 2: A well drilled by a mobile rig need not carry an alphabetical prefix.

Well No. 1

(If the well is later connected to and produced from a production platform, the well shall be redesignated to reflect an alphabetical prefix.)

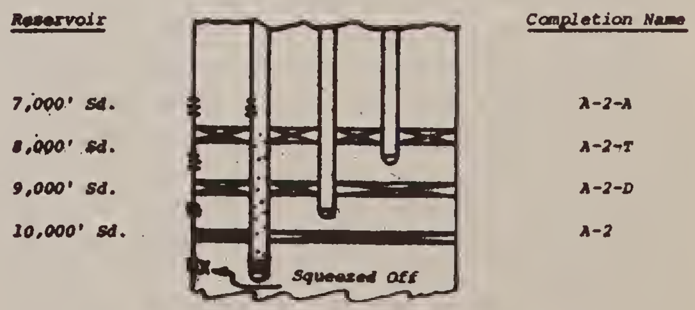
Example No. 3: The second well drilled from the A Platform is a triple completion.

| First Completion | Second Completion | Third Completion |
|---|---|---|
| A-2 | A-2-D | A-2-T |

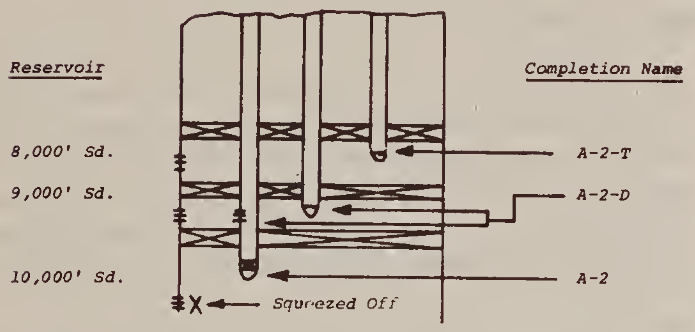
(In the above example, the letters "D" and "T" were used in naming the second and third completions utilizing current industry practice, although the intent is not to restrict operators to the use of these particular alphabetical suffixes. Any alphabetical suffix may be used as long as it is unique to the completion in that reservoir.)

Example No. 4: The drawing is shown to illustrate the fact that once a completion in a specific well bore is designated in a given reservoir, it will retain that name permanently. Let us consider the A-2 completion shown in Example No. 3. Should a recompletion be made in a different reservoir at a later date, it shall be renamed; however, the production from the reservoir associated with the original A-2 completion will always be identified with the A-2 completion. Once the A-2 completion in the 10,000′ sand is squeezed and plugged off and the recompletion made to the 7,000′ sand, the completion in the 7,000′ sand would be designated A-2-A (or some other alphabetical suffix other than the "D" or "T" presently associated with other completions in the 9,000′ and 8,000′ sands).

The Sundry Notices and Reports on Wells (Form 9-331) submitted to obtain approval for the workover shall be the vehicle for naming the new completion.



Example No. 5: If the A-2 completion in Example No. 4 had been recompleted from the 10,000′ sand to the 9,000′ sand (where the A-2-D is currently completed), the completion would still be named A-2-D as both tubing strings would be considered one completion for purposes of this Order.



## UNITED STATES DEPARTMENT OF THE INTERIOR
## GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

# OCS ORDER NO. 12

*Effective February 1, 1975*

## PUBLIC INSPECTION OF RECORDS

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.97 and 43 CFR 2.2, and supersedes OCS Order No. 12, dated August 13, 1971. Section 250.97 of 30 CFR provides as follows:

> *Public Inspection of Records.* Geological and geophysical interpretations, maps, and data required to be submitted under this part shall not be available for public inspection without the consent of the lessee so long as the lease remains in effect or until such time as the supervisor determines that release of such information is required and necessary for the proper development of the field or area.

Section 2.2 of 43 CFR provides in part as follows:

> *Determinations as to Availability of Records.* (a) Section 552 of Title 5, U.S. Code, as amended by Public Law 90-23 (the act codifying the "Public Information Act") requires that identifiable agency records be made available for inspection. Subsection (b)[1] of section 552 exempts several categories of records from the general requirement but does not require the withholding from inspection of all records which may fall within the categories exempted. Accordingly, no request made of a field office to inspect a record shall be denied unless the head of the office or such higher field authority as the head of the bureau may designate shall determine (1) that the record falls within one or more of the categories exempted and (2) either that disclosure is prohibited by statute or Executive Order or that sound grounds exist which require the invocation of the exemption. A request to inspect a record located in the headquarters office or a bureau shall not be denied except on the basis of a similar determination made by the head of the bureau or his designee, and a request made to inspect a record located in a major organizational unit of the Office of the Secretary shall not be denied except on the basis of a similar determination by the head of that unit. Officers and employees of the Department shall be guided by the "Attorney General's Memorandum on the Public Information Section of the Administrative Procedure Act" of June 1967.
>
> (b) An applicant may appeal from a determination that a record is not available for inspection to the Solicitor of the Department of the Interior, who may exercise all of the authority of the Secretary of the Interior in this regard. The Deputy Solicitor may decide such appeals and may exercise all of the authority of the Secretary in this regard.

The operator shall comply with the requirements of this Order. Any departures from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 250.12(b).

1. *Availability of Records Filed on or after December 1, 1970.* It has been determined that certain records pertaining to leases and wells in the Outer Continental Shelf and submitted under 30 CFR 250 shall be made available for public inspection, as specified below, in the Area Office, Metairie, Louisiana.

    A. *Form 9-152—Monthly Report of Operations.* All information contained on this form shall be available, except the information required in the Remarks column.

    B. *Form 9-330—Well Completion or Recompletion Report and Log.*

        (1) Prior to commencement of production, all information contained on this form shall be available, except Item 1a, Type of Well; Item 4, Location of Well, At top prod. interval reported below; Item 22, if Multiple Compl., How many; Item 24, Producing Interval; Item 26, Type Electric and Other Logs Run; Item 28, Casing Record; Item 29, Liner Record; Item 30, Tubing Record; Item 31, Perforation Record; Item 32, Acid, Shot, Fracture, Cement Squeeze, etc.; Item 33, Production; Item 37, Summary of Porous Zones; and Item 38, Geologic Markers.

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[1] Subsection (b) of section 552 provides that:

(b) This section does not apply to matters that are—

* * *

(4) Trade secrets and commercial or financial information obtained from a person and privileged or confidential;

* * *

(9) Geological and geophysical information and data, including maps, concerning wells.

(2) After commencement of production, all information shall be available, except Item 37, Summary of Porous Zones; and Item 38, Geologic Markers.

(3) If production has not commenced after an elapsed time of five years from the date of filing Form 9-330 as required in 30 CFR 250.38(b), all information contained on this form shall be available, except Item 37, Summary of Porous Zones; and Item 38, Geologic Markers. Within 90 days prior to the end of the 5-year period, the lessee or operator shall file a Form 9-330 containing all information requested on the form, except Item 37, Summary of Porous Zones; and Item 38, Geologic Markers, to be made available for public inspection. Objections to the release of such information may be submitted with the completed Form 9-330.

C. *Form 9-331—Sundry Notices and Report on Wells.*

(1) When used as a "Notice of Intention to" conduct operations, all information contained on this form shall be available, except Item 4, Location of Well, At top prod. interval, and Item 17, Describe Proposed or Completed Operations.

(2) When used as a "Subsequent Report of" operations, and after commencement of production, all information contained on this form shall be available, except information under Item 17 as to subsurface locations and measured and true vertical depths for all markers and zones not placed on production.

D. *Form 9-331C—Application for Permit to Drill, Deepen or Plug Back.* All information contained on this form, and location plat attached thereto, shall be available, except Item 4, Location of Well, At proposed prod. zone; and Item 23, Proposed Casing and Cementing Program.

E. *Form 9-1869—Quarterly Oil Well Test Report.* All information contained on this form shall be available.

F. *Form 9-1870—Semi-Annual Gas Well Test Report.* All information contained on this form shall be available.

G. *Multi-point Back Pressure Test Report.* All information contained on this form used to report the results of required multi-point back pressure test of gas wells shall be available.

H. *Sales of Lease Production.* Information contained on monthly Geological Survey computer printout showing sales volumes, value, and royalty of production of oil, condensate, gas and liquid products, by lease, shall be made available.

2. *Filing of Reports.* All reports on Forms 9-152, 9-330, 9-331, 9-331C, 9-1869, 9-1870, and the forms used to report the results of multi-point back pressure tests, shall be filed in accordance with the following: All reports submitted on these forms after the effective date of this Order shall include a copy with the words "Public Information" shown on the lower right-hand corner. All items on the form not marked "Public Information" shall be completed in full; and such forms, and all attachments thereto, shall not be available for public inspection. The copy marked "Public Information" shall be completed in full, except that the items described in 1(A), (B), (C), and (D) above, and the attachments relating to such items, may be excluded. The words "Public Information" shall be shown on the lower right-hand corner of this set. This copy of the form shall be made available for public inspection.

3. *Availability of Records Filed Prior to December 1, 1970.* Information filed prior to December 1, 1970, on Forms 9-152, 9-330, 9-331, and 9-331C is not in a form which can be readily made available for public inspection. Requests for information on these forms shall be submitted to the Supervisor in writing and shall be made available in accordance with 43 CFR Part 2.

4. *Availability of Inspection Records.* All accident investigation reports, pollution incident reports, facilities inspection data, and records of enforcement actions are also available for public inspection.

/s/ D. W. SOLANAS
*Oil and Gas Supervisor*
*Field Operations*

APPROVED: JANUARY 27, 1975

/s/ RUSSELL G. WAYLAND
*Chief, Conservation Division*

## UNITED STATES DEPARTMENT OF THE INTERIOR
## GEOLOGICAL SURVEY—CONSERVATION DIVISION

GULF OF MEXICO AREA

# OCS ORDER NO. 13

*Effective October 1, 1975*

## PRODUCTION MEASUREMENT AND COMMINGLING

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.45, 250.60, and 250.61, and 250.68.

Section 250.60 provides as follows:

> *Measurement of oil.* The lessee shall gauge and measure all production in accordance with methods approved by the Supervisor. The lessee shll provide tanks suitable for measuring accurately the crude oil produced from the lease (exact copies of 100 percent capacity tank tables to be furnished to the Supervisor) or may arrange with the Supervisor for other acceptable methods of measuring, storing, and recording production. The quantity and quality of all production shall be determined in accordance with the standard practices, procedures, and specifications generally used by the industry.

Section 250.61 provides as follows:

> *Measurement of gas.* The lessee shall measure all gas production in accordance with methods approved by the Supervisor, and the measured volumes shall be adjusted to the standard pressure base of 10 ounces above the atmospheric pressure of 14.4 pounds per square inch, a standard temperature of 60° Fahrenheit, and for deviation from Boyle's law. If gas is being disposed of at a different pressure base, the Supervisor may require that gas volumes be adjusted to conform to such base.

Section 250.68 provides as follows:

> *Commingling production.* Subject to such conditions as he may prescribe for measurement and allocation of production, the Supervisor may authorize the lessee to move production from the lease to a central point for purposes of treating, measuring, and storing, and in moving such production, the lessee may commingle the production from different wells, leases, pools and fields, and with production of other operators. The central point may be on shore or at any other convenient place selected by lessee.

The operator shall be responsible for compliance with the requirements of this Order in the installation and operation of all terminals or offshore sales points, including all facilities installed at measurement terminals or offshore sales points, whether or not operated or owned by the operator. Any departures from the requirements specified in this Order must be approved pursuant to 30 CFR 250.12(b).

1. *Definition of Terms.* As used in this Order, the following terms shall have the meanings indicated:

A. *Terminal.* Any onshore facility used in measuring the quantity and quality of produced liquids from Gulf of Mexico OCS leases for the purpose of computing royalties due the United States.

B. *Offshore Sales Point.* Any facility located on an offshore structure, at which point the produced fluids are measured by automatic custody transfer equipment, tank gauges, or meters for the purpose of computing royalties due the United States.

2. *Liquid Sales Meters.* The following requirements shall apply to all sales meters located at terminals and offshore sales points. Operators of sales meters at terminals and offshore sales points shall comply with the requirements of subparagraphs A through C by the first day of the month following six months after the date of this Order.

A. *Equipment Requirements.* Metering facilities at terminals or offshore sales points shall include the following components, which shall be compatible with the systems to which they are connected:

(1) *Meter.* Positive-displacement meter or other liquid meter approved by the Supervisor, equipped with a nonreset totalizer to remain sealed while the meter is in service. A temperature or other compensator, or a recorder, may be a component of the meter, but all such devices shall be sealed or shall be tamper proof while in service. The piping system shall be arranged to

prevent reversal of flow of liquid through the meter. Meters subjected to pressure pulsation or surges shall be adequately protected by surge tanks, expansion chambers, or similar devices. No meter shall be subjected to shock pressures which are greater than its maximum-rated working pressure. All meter installations shall be designed to operate within the gravity range specified by the meter manufacturer. The pressure and flow rate through each meter shall be maintained within manufacturer's maximum and minimum specifications for rates capacity. There shall be no bypasses around the meter.

(2) *Meter Prover*. Calibrated prover tank, master meter, or mechanical displacement proved.

(3) *Sampler*. Proportional-to-flow sampling device, with sampling point immediately upstream of the meters and downstream of any diverter valve installed upstream of the meters. The sample container shall be vaportight, with a mixing device to permit complete mixing of the sample prior to removal from the container. The sampler probe shall extend into the center of the flow piping in a vertical run. The probe shall always be in a horizontal position. The composite sample accumulated in a run period, which is the basis of the gravity and BS&W measurements, shall be representative of all crude oil delivered.

(4) *Deaerator*. When a deaerator is utilized, it shall be located upstream of the meters and shall in no case be of a smaller rated maximum capacity than that of the pump or feed lines and shall provide complete air elimination.

(5) *BS&W Monitor*. When a BS&W monitor is used it shall be installed upstream of the meters and sampling device, and designed to sound an alarm, shut down the pumps, or to divert the liquid stream back to the treater vessels, water separation tanks, or bad-oil tank in the event excessive BS&W content is detected in the oil.

B. *Gravity, BS&W, and Temperature Determinations*. The volume of metered oil shall be corrected, using factors determined as follows:

(1) *API Gravity*. The hydrometer method is the most suitable for determining the API gravity of crude petroleum. The testing procedure shall be in accordance with API Standard 2544 and ASTM Designation D287-67, Standard Method of Test for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method), 1967.

(2) *BS&W*. Determination of water and sediment in crude oils shall be in accordance with API Standard 2542 and ASTM Designation D96-68, Standard Methods of Test for Water and Sediment in Crude Oils (1968).

(3) *Temperature*. Determination of the average temperature necessary to calculate volumes at a standard temperature of 60° Fahrenheit shall be in accordance with API Standard 2543 and ASTM Designation D1086-64, American Standard Method of Measuring the Temperature of Petroleum and Petroleum Products (1964), except when the volume is determined from a temperature-compensated or temperature-recording meter.

C. *Sales Meter Proving Requirements*. The following meter proving procedures shall be followed by all operators of liquid sales meters. Calibration of the sales meters shall be witnessed by purchaser (if different from the seller), USGS, or other party acceptable to the Supervisor.

(1) *Certification*. The integrity of the calibration of each mechanical displacement prover or prover tank or master meter must be traceable to test measures which have been certified by the National Bureau of Standards.

(2) *Frequency*. Each operating meter or master meter shall be proved every month within a tolerance of fifteen (15) days, or at any other time upon request of the Supervisor.

(3) *Establishing Meter Factors*.

(a) *Prover Tank*. In establishing the meter factor with a prover tank, proof runs shall be made and recorded until two (2) consecutive runs have results within a tolerance of 0.0005 (.05 percent) prover tank volume. An average of the results of these two (2) runs will be used for the meter factor.

(b) *Master Meter*. In establishing the operating meter factor with a master meter, the master meter shall first be operating within manufacturer's specifications, calibrated with similar gravity crude and flow rate. Proof runs shall be made until three (3) consecutive runs have results within a tolerance of 0.0002. The volume of each run shall be at least ten (10) percent of the hourly rated capacity of the operating meter but must be of sufficient amount for determination of an accurate operating meter factor. The master metering installation shall include:

(i) A back-pressure valve downstream of the operating and master meter.

(ii) A check valve to prohibit back flow.

(c) *Mechanical-Displacement Prover.* In establishing the operating meter factor with a mechanical-displacement prover, a minimum of five (5) out of six (6) consecutive runs for an unidirectional prover or round trips for a bidirectional prover shall be within a tolerance of 0.0005. An average of these five runs will be used to compute the meter factor.

(d) *Preliminary Run.* For any of the three methods of proving the operating meter (prover tank, master meter, or mechanical-displacement prover), a preliminary unrecorded run should be made to equalize temperatures, displace vapors or gases, and wet the interior of the prover, where necessary. More than one run may be made. If four consecutive prover runs are made without any two consecutive runs checking within the 0.0005 tolerance, the installation shall be inspected; and if inspection discloses mechanical defects, necessary repairs shall be made.

(e) *Fluid Compressibility.* In calibrating meters with a mechanical-displacement prover, or master meter, or pressurized prover tank (volumetric provers) fluid compressibility shall be taken into account (API Standard 1101, Table II). This factor is referred to as Cpl.

(f) *Other Required Considerations.* In calibrating meters with a mechanical-displacement prover or pressurized prover tank, the following correction factors shall be taken into account:

(i) The change in prover volume due to pressure in the steel pipe (API Standard 2531, USA Standard for Mechanical-Displacement Meter Provers, Table II, Steel Correction Factor for Pressure, Cps (1963)). This correction factor is referred to as Cps and will always be unity or greater.

(ii) The change in volume of the test liquid with change in temperature as determined from API Standard 2540 and ASTM-D1250, Table 6, "Reduction of Volume to 60° F against API gravity at 60° F," (1952) or expanded tables based on the same. This correction factor is referred to as Ctl.

(iii) The change in tank shell dimensions with change in temperature (API Standard 2531, "USA Standard for Mechanical Displacement Meter Prover," Table I, "Steel Correction Factor for Temperature, Cts.," App. B (1963)). This correction factor is referred to as Cts.

(iv) API Standard 2541 and ASTM Designation D1750-62, "Standard Tables for Positive Displacement Meter Prover Tank" (1966), Table A, or expanded tables based on same, may be used where applicable. This table is a combined factor for temperature correction of liquid and steel (API Standard 2540 and ASTM Designation D1250-56, "Standard Petroleum Measurement Tables" (1966), Table 6, "Reduction of Volume to 60° F against API Gravity at 60° F," combined with a temperature factor for the cubical expansion of mild steel).

(g) *Deviation and Meter Factor.* A maximum deviation of ±0.0025 in any factor obtained since a meter was last proved or repaired, or from the original factor with a new meter, will be allowed without declaration of a malfunction. Any factor which exceeds this limit will be declared a malfunction factor. It shall be clearly indicated on the proving report when a malfunction factor has been obtained. If a malfunction factor occurs, the operator shall submit a Meter Adjustment Ticket (Form 9-1910) to adjust the volume of oil run during the period ending with the malfunction factor. The factor obtained at the beginning of the run will be used on the current ticket in the meter printer. Adjustments to the calculated run volume will be indicated on the Meter Adjustment Ticket and will eliminate the necessity of changing or adjusting the total production figure shown on the meter totalizer.

(4) *Meter Malfunction.* After a malfunction, an operating meter shall be repaired or adjusted, and recalibrated as required. The proving report must indicate the repairs or maintenance which were performed. The operator shall have a run ticket made within 24 hours after proving any sales meter and shall submit copies of all such run tickets to the Area office within 7 days after completion.

(5) *Proving Report Forms.* Meter Proving Report A (Form 9-1912) shall be used when proving meters using mechanical-displacement prover. Meter Proving Report B (9-1913) shall be used when performing meter provings using prover tanks or master meter. The operator shall submit a copy of the official proving record to the Area office within seven days after proving a meter.

3. *Sale Tanks.* Operators of liquid sales tanks and facilities shall comply with the following:

A. *Equipment Requirements.* To reduce evaporation losses, sales tank facilities shall be equipped with a pressure-vacuum thief hatch and vent-line valve, and a fill line designed to minimize free fall and splashing.

B. *Calibration Chart.* A complete set of calibration charts (tank tables) for each tank shall be submitted to the Area office. Tank calibrations shall be according to API Standard 2550 and ASTM Designation D1220-65, "Measurement and Calibration of Upright Cylindrical Tanks" (1966) and shall be performed by qualified personnel, subject to witnessing by representatives of the purchaser, seller, and USGS.

C. *Gauging and Sampling.* Gauging of storage tanks shall be performed according to API Standard 2545, and ASTM Designation D1085-65, "USA Standard Method of Gauging Petroleum and Petroleum Products" (1965), and sampling of petroleum and petroleum products in accordance with API Standard 2546 and ASTM Designation D270-65, "Standard Method of Sampling Petroleum and Petroleum Products" (1965).

D. *Temperature Correction.* The change in volume of the liquid with the change in temperature shall be determined from API Standard 2540 and ASTM Designation D1250, Table 6, "Reduction of Volume to 60° F against API Gravity at 60° F" (1952), or expanded tables based on the same. Reduction for BS&W shall be made after making the correction for temperature.

4. *Allocation Meter Facilities.* Allocation meter facilities shall include the following components:

A. *Meter.* Positive-displacement meter, positive volume meter, turbine meter, or other acceptable measurement equipment.

B. *Meter Prover.* Calibrated mechanical-displacement prover, master meter, or prover tank.

C. *Sampler.* Equipment for continuous or periodic liquid sampling.

5. *Gas Measurement.* The operator shall be responsible for compliance with the requirements of this Order pertaining to all sales meters at their delivery points and all meters used for allocation purposes.

A. *Standards for Measurement.* The following requirements shall apply to all meters:

(1) *Equipment.* The measuring equipment so installed shall conform to and shall be operated in accordance with the specifications and the recommendations contained in the American Gas Association publication Orifice Metering of Natural Gas, Gas Measurement Committee Report No. 3, including the appendix as published September 1969.

(2) *Deliveries.* The volume of gas delivered shall be in accordance with the specifications and the recommendations contained in said Gas Measurement Committee Report No. 3.

B. *Specifications for Measurement.* The following requirements shall apply to all gas meters:

(1) *Sales Unit.* For purposes of reporting sales, the measurement unit shall be one MCF of gas (1,000 cubic feet).

(2) *Unit of Volume.* For purposes of Calculation, the unit of volume shall be one cubic foot at a base temperature of 60° Fahrenheit and at a base pressure of 15.025 pounds per square inch absolute.

(3) *Pressure Base.* For purposes of measurement and meter calibration, the atmospheric or barometric pressure shall be assumed to be constant at 14.7 pounds per square inch absolute.

(4) Test Frequency. The accuracy of the measuring equipment at the point of delivery or allocation shall be tested at reasonable intervals, not to exceed forty-five (45) days.

(5) *Malfunction.* If at any time the measuring equipment is found to be out of service or not registering within the limits prescribed by the manufacturer, it shall be repaired or adjusted to read accurately. If the error in the measuring equipment is found to be within two percent, previous readings of such equipment shall be considered correct in computing the deliveries of gas thereunder. If the error in the measuring of equipment is found to be more than two percent, the volume measured since the last calibration shall be corrected. The volume adjustment should be calculated from the time the error occurred, if such time is ascertainable, and if not ascertainable, then back one-half of the time elapsed since the last date of calibration or as much as 23 days. If for any reason the measuring equipment is out of service or malfunctioning with the result that the quantity of gas delivered is not known, the volume of gas delivered through the period during which such equipment is out of service or malfunctioning shall be estimated on the basis of the best data available, using one of the following methods in order of priority.

(a) By using the registration of any check-measuring equipment if installed and accurately registering; or

(b) By correcting the error if the percentage of error is ascertainable by calibration, test, or mathematical calculations; or

(c) By estimating the quantity of delivery by reference to actual deliveries during preceding periods under similar conditions when the unserviceable equipment was registering accurately.

C. *Witnessing.* The tests and calibrations made under Paragraph B above shall be run by qualified personnel. Representatives of the seller, buyer, and USGS shall have the right to witness such tests and calibrations.

D. *Record Retention.* The operator shall preserve or cause to be preserved all test data, meter reports, charts, or other similar records for a period of not less than one year. At any time within such period, the Supervisor may request such records and charts, subject to return within 20 days from receipt thereof.

E. *Record Submittal.* Upon request, one copy of the meter reports specified in D above shall be forwarded to the Supervisor. No special form is required, but all meter report forms shall include the following information where applicable:

(1) *Producer or Seller.*

(2) *Purchaser.*

(3) *OCS lease number or other identifying designation.*

(4) *Station or meter number.*

(5) *Time and date of test.*

(6) *Location.*

(7) *Meter data (make, serial number, differential range, static range).*

(8) *Type connections (flange or pipe).*

(9) *Orifice data ("found" and "left" for line size and orifice size).*

(10) *Zero data for differential and for static spring.*

(11) *Calibration data ("found" and "left" for differential and for static).*

(12) *Remarks.*

(13) *Signature and affiliation of tester.*

(14) *Signature and affiliation of witness.*

6. *Commingling of Production.* Commingling production of different ownership and/or from different leases prior to sales shall be subject to the approval of the Supervisor prior to the actual commingling. Unless otherwise established, the sales delivery shall be considered on the lease and appropriate measurement shall be provided. Well production test may be approved for allocation purposes.

A. *Applications.* Applications for approval of a commingling procedure shall contain the following information:

(1) An accurate description of any measuring devices and samplers, including schematics of the total system, and detailed sections.

(2) A list of the leases and fields involved.

(3) The estimated amounts and types of production involved.

(4) Details of the allocation procedure.

(5) Description of calibration equipment and intervals.

(6) Sales contract, agreement for disposal, or posted price.

B. *Allocation Schedule.* If production from more than one lease or owner is measured by the same sales meter, an allocation schedule of the monthly sales volume of commingled production shall be furnished to the Supervisor. The allocation schedule shall contain:

(1) Total sales volume.

(2) All storage volumes located upstream of the sales meter on the first and last day of the month.

(3) Total lease production from actual allocation meter readings with appropriate corrections (if allocated by meter measurements).

(4) Total lease production calculated from required well tests (if allocated by well test).

(5) Final allocation of actual sales to contributing leases.

7. *Automatic Custody Transfer.* Automatic custody transfer shall be subject to approval of the Supervisor.

A. *Application.* An application to the Supervisor for approval of the meter measurement and facilities shall include:

(1) Flow schematic of the ACT Unit showing and labeling all components.

(2) Leases and fields involved.

(3) Estimated amounts and types of production involved.

(4) Calibration documents for the prover.

B. *ACT Failure.* Any ACT failure, such as electrical, meter, prover loop, or other failure (this does not include malfunction as defined in subparagraph 2.C.(4) of the Order), which may require other methods of measurement shall be reported to the Supervisor within 24 hours. The Supervisor shall approve other methods of measurement during the ACT failure period. A complete, detailed report shall be submitted to the Supervisor within 10 days.

8. *Accidents.* Any accident causing fire, damage to equipment, serious injuries, or pollution shall be reported to the Supervisor within 24 hours. A complete, detailed report shall be submitted to the Supervisor within 10 days.

/s/ J. B. LOWENHAUPT
*Oil and Gas Supervisor*
*Production Control*
*Gulf of Mexico Area*

APPROVED:

/s/ RUSSELL G. WAYLAND
*Chief, Conservation Division*

# UNITED STATES DEPARTMENT OF THE INTERIOR
# GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

## OUTER CONTINENTAL SHELF
*Guidelines to OCS Order No. 14*

*Introduction.* The purpose of OCS Order No. "14" is to assure diligence in the development of the OCS's natural resources by allowing limited suspensions of operations or production while the operator is waiting for the installation of equipment or granting of permits necessary for the production or transportation of oil and gas from a lease. The standards in the Order are to be strictly applied, and a suspension should be granted only if the supervisor is satisfied that it will promote the development of the lease.

Although the supervisor may approve a request for suspension on several separate grounds, it is not intended that separate suspensions should be granted each time an operator meets the requirements of a separate category. For example, if an operator is waiting for equipment, but will also need a permit, whenever possible he should be required to do both at the same time, and should not get separate or successive suspensions for each.

Some of the types of factors that reflect on the operator's good faith and his actions to expedite production from the lease are listed below. These and other similar factors should be considered by the supervisor when he decides whether to grant a suspension request.

For ease of reading, the relevant part of the draft Order is repeated within quotation marks, before the associated guidelines are presented.

### SUSPENSIONS OF PRODUCTION TO FACILITATE PROPER DEVELOPMENT

A...is waiting for completion of drilling platform construction and installation or delivery of equipment or facilities which are necessary for production and for which the lessee has signed a contract that specifies a delivery date; or

*Guidelines.*

1. Incomplete construction, or undelivered equipment or facilities, is not by itself sufficient justification for granting a suspension. The operator shall show to the satisfaction of the supervisor:

   (a) that the undelivered or incompletely installed equipment is essential for producing oil and gas from the lease; and

   (b) that the operator has made a timely and diligent effort to obtain the equipment;

   (c) that the delivery or completion date in the contract is reasonable. To decide whether the time for delivery or completion stated in the contract is reasonable, the supervisor should compare it with the time needed to perform similar contracts. Of course, he shall also consider any other information that may aid him in making his determination.

2. As a condition for the suspension, the supervisor shall require the operator to continue doing any useful activity that will promote the early production of oil and gas from lease.

B...has pending before any Federal, State or local government authority, an application for a permit which is necessary before the lessee can produce oil or gas from the lease; or

*Guidelines.*

1. When granting suspensions under this provision it is important for the supervisor to be sure the provision is not being abused. The operator must show to the satisfaction of the supervisor that a bona fide application with a reasonable chance of success is involved. Successive applications made within a short period of time on the same or nearly the same terms as applications for permits or prices previously denied should not, for example, be considered bona fide applications.

2. Whenever possible, if more than one permit or license is necessary before the lessee

can produce from the lease, the supervisor shall require that the operator submit all of the applications at the earliest possible time. Separate consecutive suspensions should not normally be granted for different applications when such applications can be acted upon during a single suspension period.

3. If other useful activity can be performed while the application is under review, and the investment in such activity will not be lost if the permit is not granted, the supervisor shall require that the useful activity be continued while the permit application is pending.

C...has submitted to the Department of the Interior and is actually conducting a geological and geophysical exploration or development program that includes drilling to develop sufficient reserves to produce either from the lease alone or in connection with other leases. For purposes of receiving a suspension under this provision, drilling activity on one lease may be determined by the supervisor to be activity on all leases which are to be considered as a unit for purposes of providing sufficient reserves to establish economic justification for the construction of a pipeline necessary to transport such reserves from the subject leases.

*Guidelines.*

1. The purpose of this provision is to allow a suspension of a lease while the lessee is actively attempting to prove up enough reserves to justify a pipeline. To grant a suspension under these conditions, the supervisor shall require a report from the lessee showing:

(a) the specific leases to be considered as a unit for purposes of justifying the construction of a pipeline.

(b) the quantity of reserves already found on each lease.

(c) the minimum quantity of reserves required to justify the pipeline.

(d) an economic analysis showing how the estimated minimum quantity of reserves was determined and the assumptions used in arriving at the determination.

2. Mere proposals for further exploration do not meet the requirements of this section.

## SUSPENSION OF PRODUCTION BECAUSE OF LACK OF TRANSPORTATION FACILITIES

A...is waiting for the completion of pipeline construction, or delivery of pipeline equipment or facilities which are necessary for the transportation of oil and gas and for which the lessee has signed a contract that specifies the completion or delivery date, or

*Guidelines.*

1. An incomplete pipeline or undelivered equipment or facilities is not by itself sufficient justification for granting a suspension. The operator shall show to the satisfaction of the supervisor:

(a) that the underlivered or incompletely installed equipment is essential for producing oil and gas from the lease; and

(b) that the operator has made a timely and diligent effort to obtain the equipment; and

(c) that the delivery or completion date in the contract is reasonable. To decide whether the time for delivery or completion stated in the contract is reasonable, the supervisor should compare it with the time needed to perform similar contracts. He should also consider any other information that may aid him in making this determination.

2. As a condition for the suspension the supervisor shall require the operator to continue doing any activity that will promote the early production of oil and gas from the lease.

B...has pending before any Federal, State, local government authority an application or a permit which is necessary before the lessee can transport oil and gas from the lease, or

*Guidelines.*

1. The operator must show to the satisfaction of the supervisor that a bona fide application with a reasonable chance of success is involved. Successive applications made within a short period of time on the same or nearly the same items as applications for permits or prices previously denied should not, for example, be considered bona fide applications.

2. Whenever possible, if more than one permit or license is necessary before the lessee can produce from the lease, the supervisor shall require that the operator submit all of the applications at the earliest possible time. Separate consecutive suspensions should not normally be granted for different applications when such applications can be acted upon during a single suspension period.

3. If other useful activity can be performed while the application is under review, and the investment in that activity will not be lost if the application is not granted, the supervisor should require that the useful activity be continued while the permit application is pending.

C...has a contract to use an existing pipeline, but is unable to use the pipeline for reasons beyond the lessee's control.

*Guidelines.*

1. The operator must show that he has not caused or contributed to his inability to use the pipeline. Suspension of rights to operate by State agencies or acts of God may justify a suspension under this section.

2. If a suspension is granted, the supervisor shall require the operator to seek alternative means of transportation.

## UNITED STATES DEPARTMENT OF THE INTERIOR
## GEOLOGICAL SURVEY—CONSERVATION DIVISION
GULF OF MEXICO AREA

# PROPOSED OCS ORDER NO. 14

*Effective:*

### APPROVAL OF SUSPENSIONS OF PRODUCTION

This Order is established pursuant to the authority prescribed in 30 CFR 250.11 and in accordance with 30 CFR 250.12(d).

If the supervisor in his discretion approves a request for suspension of production pursuant to 30 CFR 250.12(d)(i) and (ii), the terms of the lease will not be deemed to expire as long as the suspension remains in effect.

The supervisor may not approve a request for a suspension to facilitate proper development or for lack of transportation facilities unless he is satisfied that the lessee: (1) has made the request in good faith; and (2) is taking and will continue to take all reasonable actions to expedite the production of oil and gas from the lease.

1. *Suspension of Production to Facilitate Proper Development.* A lease on which a well has been drilled and determined by the supervisor to be capable of being produced in paying quantities according to the provisions of OCS Order No. 4 and thereafter temporarily abandoned or permanently plugged and abandoned is being properly developed if the lessee:

A. Is waiting for completion of drilling platform construction and installation, or delivery of equipment or facilities which are necessary for production and for which the lessee has signed a contract that specifies a delivery date; or

B. Has pending before any Federal, State, or local Government authority, an application for a permit which is necessary before the lessee can produce oil or gas from the lease; or

C. Has submitted to the Department of the Interior a development plan or unitization agreement for the lease and is waiting for the Department to complete action on the plan or agreement; or

D. Has submitted to the Department of the Interior and is actually conducting a geological and geophysical exploration or development program, that includes drilling to develop sufficient reserves to produce either from the lease alone, or in connection with other leases. For purposes of receiving a suspension under this provision, drilling activity on one lease may be determined by the supervisor to be activity on all leases which are to be considered as a unit for purposes of providing sufficient reserves to establish economic justification for the construction of a pipeline necessary to transport such reserves from the subject lease.

2. *Suspension of Production Because of Lack of Transportation Facilities.* A lease on which a well has been drilled and determined by the supervisor to be capable of being produced in paying quantities, according to the provisions of OCS Order No. 4, and thereafter temporarily abandoned or permanently plugged and abandoned, cannot be produced because of lack of transportation facilities if the lessee:

A. Is waiting for the completion of pipeline construction, or delivery of pipeline equipment or facilities which are necessary for the transportation of oil and gas and for which the lessee has signed a contract that specifies the completion or delivery date; or

B. Has pending before any Federal, State, or local government authority an application or a permit which is necessary before the lessee can transport oil and gas from the lease; or

C. Has a contract to use an existing pipeline, but is unable to use the pipeline for reasons beyond the lessee's control.

/S/ OIL AND GAS SUPERVISOR

APPROVED: DECEMBER 12, 1975

/S/ EDDIE R. WYATT
*Acting Chief*
*Conservation Division*

(FR DOC. 75-34199 FILED 12-18-75;8:45 AM)

# APPENDIX C

# AN EXAMPLE OF A NOTICE TO LESSEES AND OPERATORS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
GULF OF MEXICO AREA

75-3 January 20, 1975
(SUPERSEDES No. 74-10)

## NOTICE TO LESSEES AND OPERATORS OF FEDERAL OIL AND GAS LEASES IN THE OUTER CONTINENTAL SHELF, GULF OF MEXICO AREA

## MINIMUM GEOPHYSICAL SURVEY REQUIREMENTS TO PROTECT CULTURAL RESOURCES

Recent OCS leases include stipulations concerning archaeological surveys. Should such an archaeological survey be required in the leased area, or area sought for permit, the following minimum requirements must be fulfilled. These requirements will be effective as of the date of this notice and shall apply also to all existing leases that contain archaeological stipulations, including MAFLA leases, where the archaeological surveys have not yet been conducted.

Prior to drilling operations or the installation of any structure or pipeline, the lessee shall conduct a high resolution geophysical survey in the immediate area to determine the possible existence of a cultural resource. The following equipment is required in performing the survey. All equipment shall be representative of the state of technological development.

A. Magnetometer - Total field intensity instruments are needed. The sensor of the magnetometer should be trailed as near as possible to the sea floor; six meters or less is recommended. Knowledge of the sensor depth of tow above the bottom is highly desirable for future analyses.

B. Dual Side Scan Sonar - Coverage of the sea floor at a range width of at least 150 meters per side in the proposed area is needed.

C. Depth Sounder and Sub-bottom Profiler - An analog recorder shall be used for bathymetry and the profiler shall be capable of resolving the upper 50 feet of sediment.

Navigation for the survey shall utilize state-of-the-art positioning systems correlated to annotated geophysical records. Navigation accuracy shall be on the order of ± 50 feet at 200 miles.

Optional tools could include cameras, underwater TV, divers, and cores. Any engineering soil borings which are obtained shall be made available for the archaeologist's inspection. These data shall be evaluated for indications of aboriginal habitation sites as well as for historic sites.

The track or survey line spacing shall follow the attached illustrated plans.

For a single-drill site or platform location, all geophysical equipment shall run an area approximately one mile square with eleven principal survey lines spaced 150 meters apart with three cross-lines. In addition, two diagonal lines centered on the proposed drill site shall be run. (See attached plan A).

For an entire lease block, or significant portions, a 150 meter x 1000 meter spacing shall be used. (See attached plan B).

For a pipeline installation, three principal survey lines shall be run, one following the exact course of the proposed pipeline with an offset line on either side spaced to coincide with the area which would be disturbed by the barge anchors. The distance of these offset lines from the proposed pipeline route cannot be stated specifically since this is a function of water depth and equipment. (See attached plan C).

A professional underwater archaeologist is not required to be present on all survey activities. A geophysicist must accompany the survey to insure that the equipment is properly tuned and records are accurate and readable. The records shall be inspected by the archaeologist along with the survey geophysicist who shall advise the archaeologist as to the record quality and anomaly occurrences. The data will be maintained by the lessee and shall be available to BLM and USGS upon request.

## Survey Report Format

The archaeological survey shall include, as a minimum, the following:

1. Description of tract surveyed to include tract number, OCS number, block number, geographic area, e.g., Mobile South No. 1 Area, and water depth.
2. a) Map (1" = 2,000') of the lease block showing the area surveyed.

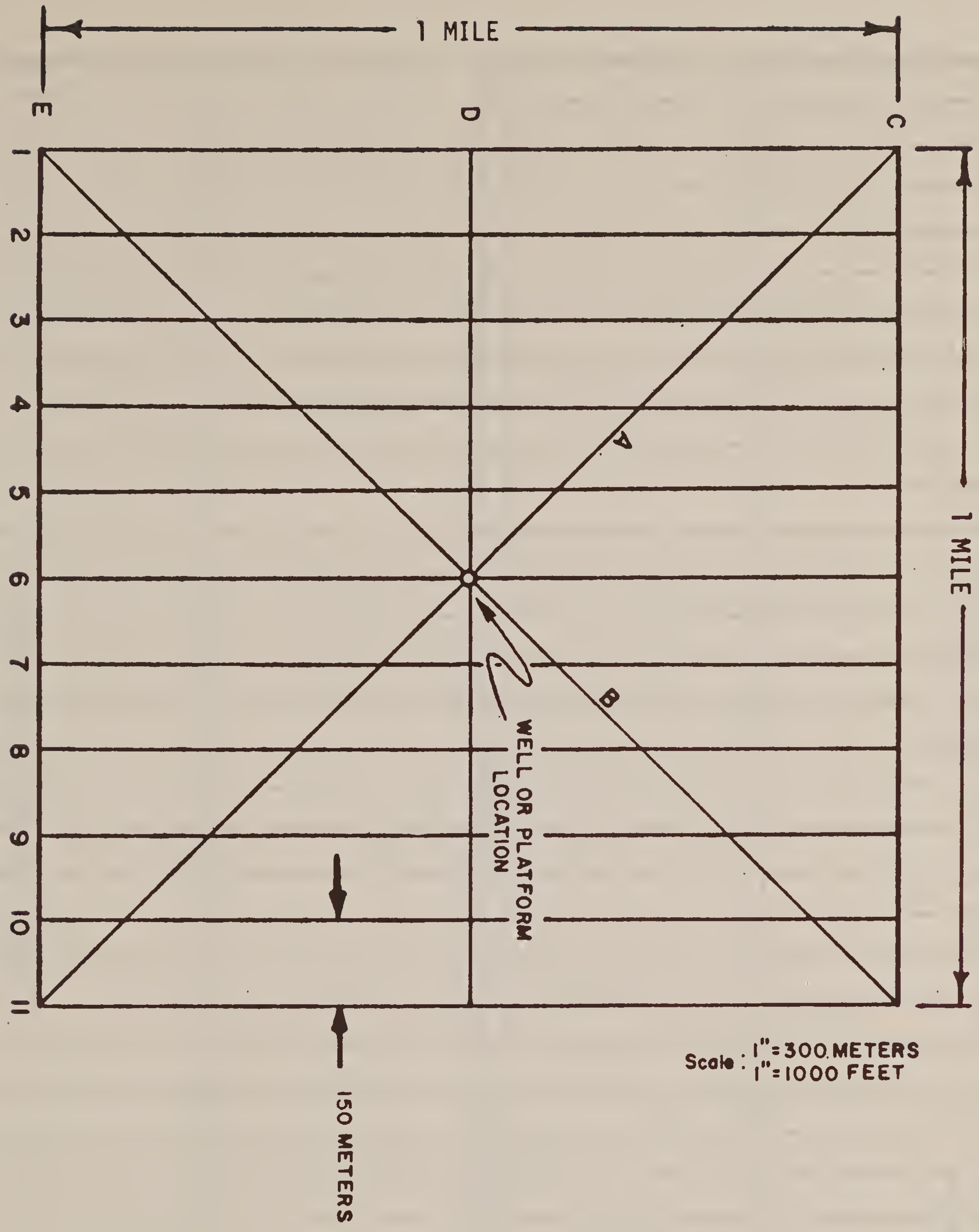
   b) Navigation postplot Map (1" = 1,000') of area surveyed showing tract lines and shotpoints with U.T.M. X and Y coordinates and latitude-longitude reference points.
3. Survey personnel and duties.
4. Survey instrumentation, procedures and logs.
5. Sea state.

6. The original of a selected line of survey data for each instrument used shall be submitted with each report. In all cases where an anomaly is encountered, the original of all survey data for the line(s) indicating the anomaly shall be submitted.

7. Archaeological assessment, with a signed statement as to the possible existence of a cultural resource.

8. Two copies of the report shall be submitted to this office and also two copies to the New Orleans OCS office, BLM.

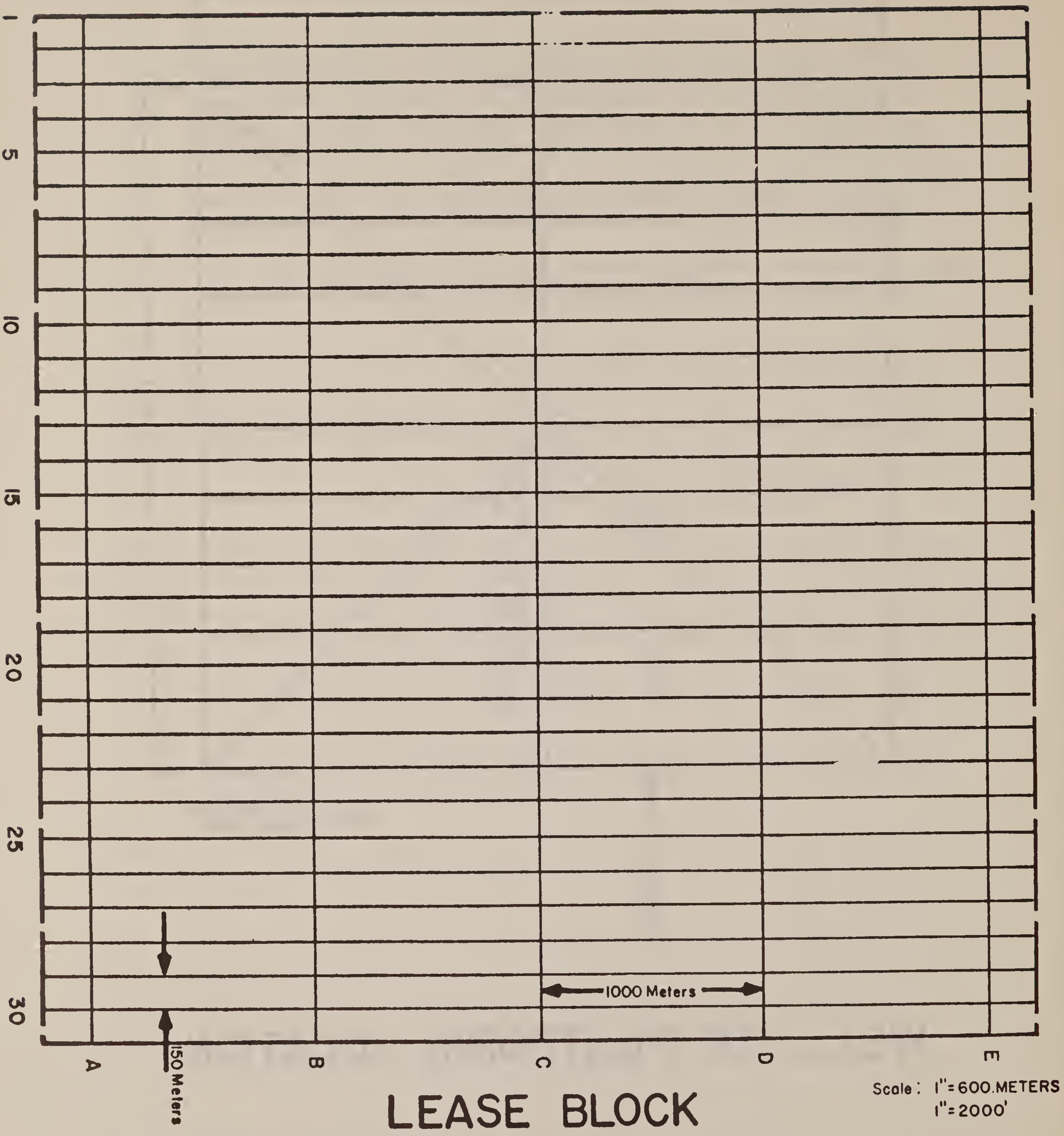
/s/ D. W. Solanas
Oil and Gas Supervisor
Field Operations
Gulf of Mexico Area



WELL OR PLATFORM LOCATION

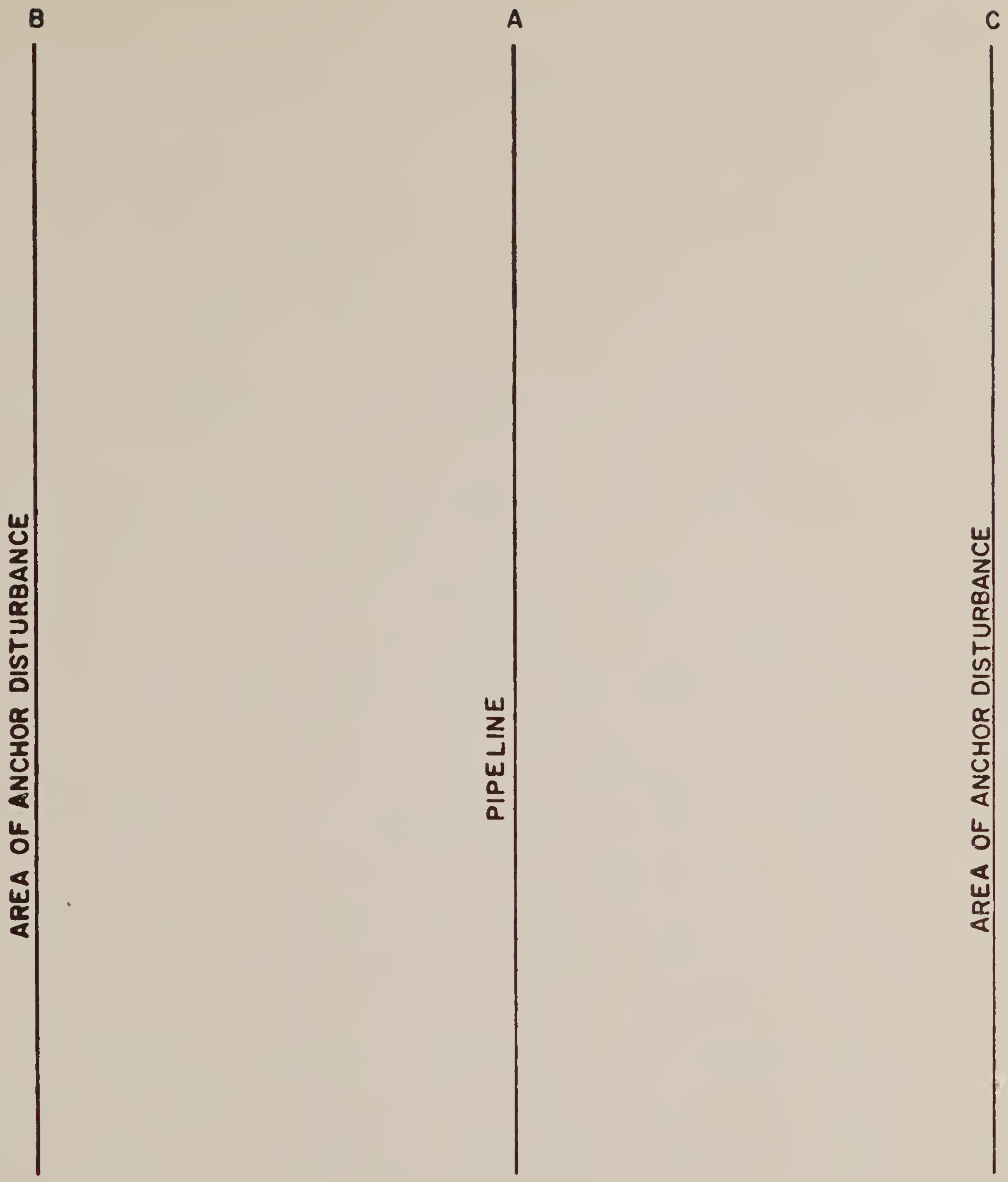
GEOPHYSICAL SURVEY GRID TO DETERMINE
THE EXISTENCE OF CULTURAL RESOURCES

PLAN "A"



GEOPHYSICAL SURVEY GRID TO DETERMINE
THE EXISTENCE OF CULTURAL RESOURCES

PLAN "B"



PROPOSED PIPELINE ROUTE

No Scale

GEOPHYSICAL SURVEY GRID TO DETERMINE THE EXISTENCE OF CULTURAL RESOURCES

PLAN "C"

#3202996 ID:88076078

TD
195
.P4
G854
1976b
v.1

# Source References Utilized to Prepare the Visual Graphics for Proposed OCS Lease Sale No. 44.

## General Gulf of Mexico

Visual No. 1 - Submarine physiography of the Gulf of Mexico.

Bergantino, R.N., 1969. Submarine physiography of the Gulf of Mexico.

Visual No. 2 - Tropical storms in the Gulf of Mexico and Atlantic Ocean, 1954-1975.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, National Hurricane Center, Coral Gables, Florida.

Visual No. 3 - Phytoplankton production and benthic plant distribution.

1) Bogorov, V.G. et al., 1968. In: Atlas of the Living Resources of the Seas. Prepared by - FAO Dept. of Fish. Rome (1972).

2) Earle, S.A., 1972. Benthic Algae and Seagrasses. In: Chemistry, Primary Productivity and Benthic Algae of the Gulf of Mexico. El-Sayed et al. (eds.). Serial Atlas of the Marine Environment, Folio 22 Amer. Geog. Soc., New York. 29 p. 6 Vols.

3) Koblentz, Mishke, Volkovensky, and Kabanova, 1969. In: Atlas of the Living Resources of the Seas. Prepared by - FAO Dept. of Fish. Rome (1972).

Visual No. 4 - Gulf of Mexico pelagic and industrial fisheries.

1) Bogdanov, A.S., 1969. Soviet-Cuban fishery research. Published for the U.S. Dept. of Interior and National Science Foundation, Washington, D.C. by the Israel Program for Scientific Translations. 350 p.

2) FAO, 1972. Atlas of the Living Resources of the Seas. Prepared by FAO Dept. of Fish. Rome.

3) Haskell, W.A., 1961. Gulf of Mexico trawl fishery for industrial species. Commercial Fish. Rev., Vol. 23, No. 2, Washingtion, D.C. 6 p.

Visual No. 5 - Gulf of Mexico penaeid shrimps.

1) FAO, 1972. Atlas of the Living Resources of the Seas. Prepared by FAO Dept. of Fisheries. Rome.

2) Knopf, G.M., 1970. Opportunities in the shrimp fishing industry of the southeastern United States. University of Miami Sea Grant Institutional Program. Sea Grant Inform. Bull. No. 3. 28 p.

3) U.S. Dept. of Commerce, NOAA, NMFS, Washington, D.C.

Visual No. 6 - Transportation and coastal refining centers.

U.S. Department of Interior, Bureau of Land Management, Environmental and Socioeconomic Baseline on the Gulf of Mexico Coastal Zone and Outer Continental Shelf. Volume 3, Socio-Economic Inventory and Analysis.

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